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PRESENTATION OF A GREAT MACE TO THE AMERICAN COLLEGE OF SURGEONS BY THE CONSULTING SURGEONS OF THE BRITISH ARMIES.

ON MONDAY, OCTOBER 11, 1920, IN MONTREAL.

THE MACE has been designed to tell in symbolic language of the close union between British and American Surgery, and of the ties which unite Great Britain to Canada and to the United States of America. It retains the traditional shape and proportions of the civic mace of the seventeenth century, and is of hand-wrought, chiselled and repoussé silver gilt. It has been designed and made by Mr. Omar Ramsden, who has also embodied some suggestions of Sir Berkeley G. A. Moynihan, K.C.M.G., and Sir D'Arcy Power, K.B.E.

THE DEDICATORY INSCRIPTION engraved on the plate under the Crown sets forth that it is a gift "From the Consulting Surgeons of the British Armies to the American College of Surgeons, in memory of mutual work and good-fellowship in the Great War, 1914–1918".

THE CROWN-SHAPED FINIAL is formed of six rich scroll buttresses upholding the "Sacred Flame of Science" issuing from a mortar of antique pattern, the model of which was recently found on the field of battle near Salonika. These buttresses spring from a cresting composed of alternating Maple Leaves and American Eagles intertwined with the Serpents of Æsculapius; while the position usually occupied by a band of jewels in a monarchal crown is filled with the words "The American College of Surgeons".

THE BODY OR HEAD is divided into six panels by the Winged Caduceus being an ornamental rendering of the badge of the United States Army Medical Corps. The panels set forth the following "Achievements at Arms" in delicate and finely detailed repoussé work:—

1st. The full Blazon of the United States of America.
2nd. The Dominion of Canada.
3rd. The Royal College of Surgeons of England.
4th. The Badge of the Royal Army Medical Corps.
5th. The Shields of Arms of John Hunter and Lord Lister.
6th. A cartouche bearing the words "Philip Syng Physick, 1768–1837, Father of American Surgery".

The lower portion of the head is decorated with a symbolic band of water indicating the ocean which both unites and separates America and the Mother Country. The latter is symbolized by the British Lion brackets of highly chiselled work which support the head and terminate the upper part of the staff. The talons of the Lions' feet grip the hammered decoration of the upper knop, which consists of a design of American and Canadian maple seed-pods and heart-shaped spaces. This hammered work is protected by boldly-projecting, solid, jewel-like bosses of chiselled work.

THE STAFF is decorated with a free design of the national floral emblems of the United Kingdom—the Rose, the Thistle, the Shamrock, and the Leek. Intertwined among these are a number of ribbon scrolls, each of which bears the name of one of the donors.

THE FOOT bears, as decoration, the root form from which the above spring, and a series of six small shields which may be used for possible future armorial bearings, or inscriptions. The extreme bottom knop is fluted with leaves of *Isatis tinctoria*.

The various parts are held together, in the traditional manner, by a rod of English oak cut from a tree grown at Wytham, Berks. The extreme length is 3 ft. 11⅛ in., and the weight of silver is 140 oz. troy.

THE CONSULTING SURGEONS OF THE BRITISH ARMIES WHO GAVE THE GREAT MACE TO THE AMERICAN COLLEGE OF SURGEONS.

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Sir Hamilton Ballance, K.B.E., C.B.
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Seymour Barling, C.M.G.
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A. B. Mitchell, O.B.E.
Sir Berkeley Moynihan, K.C.M.G., C.B.
Sir Thomas Myles, C.B.
T. H. Openshaw, C.B., C.M.G.
Colonel A. Pilcher, C.B., D.S.O.
Owen Richards, C.M.G., D.S.O.
Sir Hugh Rigby, K.C.V.O.
Percy Sargent, C.B., D.S.O.
James Sherren, C.B.E.
Maynard Smith, C.B.
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Sir Charles Gordon Watson, K.B.E., C.M.G.
A. Webb-Johnson, C.B.E., D.S.O.
Sir W. de C. Wheeler.

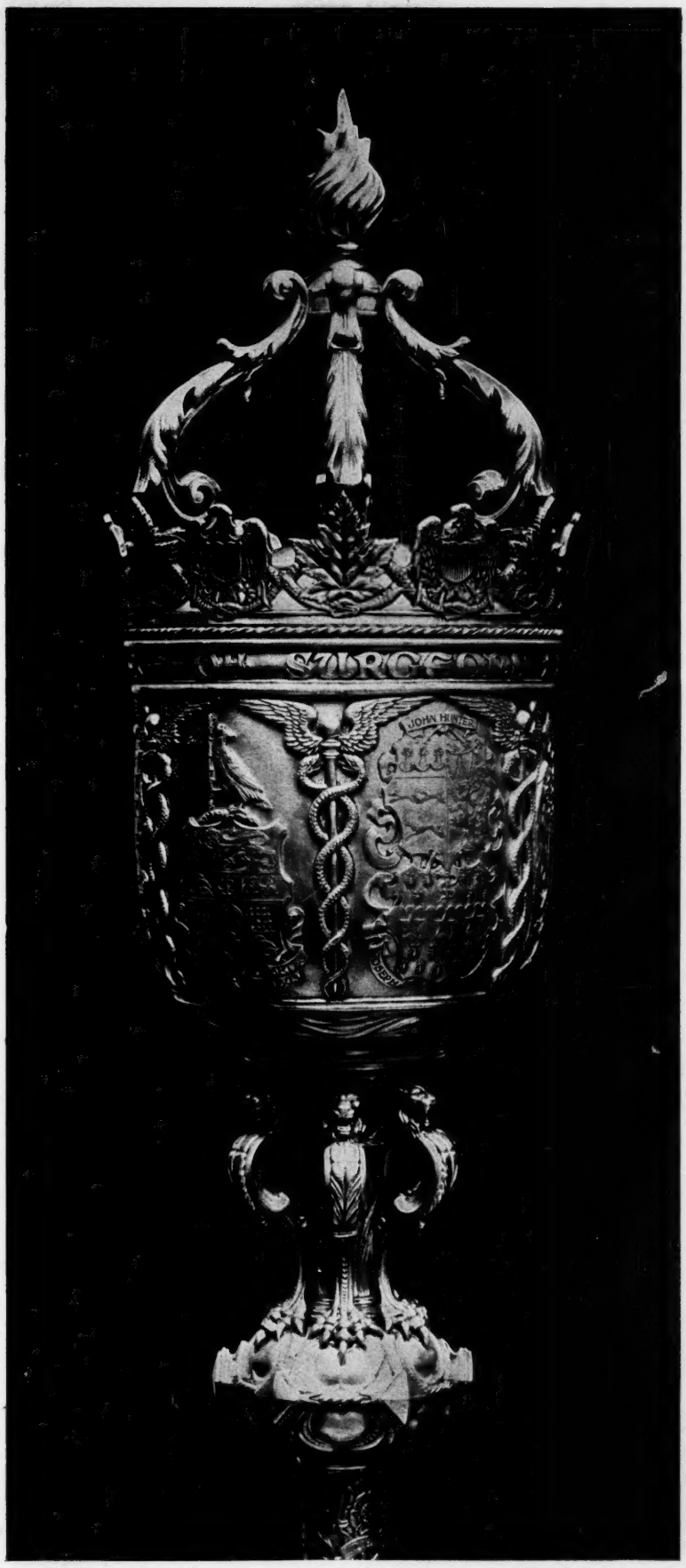
The Mace was taken to Montreal by Sir Berkeley Moynihan, Sir William Taylor, and Mr. Albert Carless, and the presentation was made by Sir Berkeley Moynihan, who said:—

"Three centuries ago, on this very day, a little sailing vessel, leaving England far behind her, was struggling against adverse winds and heavy seas towards America. On board were one hundred pilgrims fleeing from civil and religious tyranny to seek sanctuary and freedom in a new land. No voyage in history has been so fateful. Those who journeyed in that vessel, a chosen company on the horizon of your history, were the best of English stock. They helped to found here a small colony of people, grim and stoical in spirit, yet touched with idealism. Though all the great countries of the earth have since given of their best to build this nation, those few pilgrims have left their indelible stamp upon the culture, the institutions, and the laws of this land.

"Almost a century and a half ago that colony broke away from the Mother Country, with which it was long at war. But one hundred years of peace between the two nations had been celebrated when, in 1917, they stood together in arms. War is the Great Revealer. We learnt in that great testing time of our race that ties of blood, when they mean kinship in spirit and an equal surrender to the noblest impulse, are never to be broken. In the Great War America and the Empire mingled their blood upon the same stricken field. The hope then grew strong in many hearts that a new understanding born of comradeship in battle, fiercely tested in the furnace of affliction, and sealed in death, would redeem the ancient blunders, blot out the bitter memories of wrong, and lead at last to a supreme and permanent reconciliation. For we seemed then to realize that deep down in the hearts, enthroned in the conscience of the two peoples, there was the same full eager devotion to eternal principle, love of justice, joy in liberty, hatred of oppression; the same unselfish determination to strive for the redemption of mankind, and to establish anew the freedom of the world. On the fields of Flanders and of France, as in the cabin of the Mayflower, humanity recovered its rights.

"In the grave and anxious days of war, when we fought so long in fellowship,

THE GREAT MACE PRESENTED IN MONTREAL TO THE AMERICAN COLLEGE OF SURGEONS



BY THE CONSULTING SURGEONS OF THE BRITISH ARMIES ON OCTOBER 11, 1920

no associations were closer, no friendships more swift and intimate, no joint labours more fruitful than were those of the members of our profession coming from America and from every part of the British Empire. We then gained, each for the other, not respect and sympathy alone, but true affection also. Every lover of his country, every lover of humanity, must wish that the spiritual alliance then created shall endure to the end of time. In our desire to perpetuate the remembrance of those days of duty done together, we, the Consultant Surgeons of the Armies of Britain, ask the College of Surgeons of America, meeting in this great Dominion, to accept this Mace. We pray that you may regard it as a symbol of our union in the harsh days of trial; as a pledge of our devotion to the same imperishable ideals; as a witness to our unfaltering and unchanging hope that the members of our profession in the two lands shall be joined in brotherhood for ever in the service of mankind."

Colonel G. E. ARMSTRONG, C.M.G., President of the American College of Surgeons, in receiving the Mace, said:—

"Sir Berkeley Moynihan: As President of the American College of Surgeons, I accept this beautiful Mace presented by you on behalf of the Consulting Surgeons of the British Armies, with thanks and a full appreciation of the care and thought bestowed upon its design and construction.

"We accept it as a token of the cordial relationship that obtains between the surgeons of the two great nations here represented. It is the symbol of the zeal and enthusiasm in our art that, originating in the Old World, has spread to the New.

"We shall endeavour in this western hemisphere to keep the 'Sacred Flame of Science' burning not less brightly than have our forebears in Great Britain. It will remain with us as an emblem of unity, a work of art, a remembrance of the united effort of the two great English-speaking nations to give truth, liberty, and justice to all peoples and to all nations.

"The scientific fire represented in this gift welds another link in the chain that shall for ever bind us together in the great work of promoting the highest possible standard of surgery, as well as peace and good-will among men.

THE EDUCATION OF A SURGEON UNDER THOMAS VICARY.

By Sir D'ARCY POWER, K.B.E., London.

(The Second Vicary Historical Lecture, delivered at the Royal College of Surgeons of England on November 11, 1920.)

Mr. President, Master of the Worshipful Company of Barbers, Ladies and Gentlemen :—

It is a function of history to correct the errors into which we are betrayed by mere forgetfulness. Generation succeeds generation until we are apt to think that our fathers were less skilful, or were less alive to their surroundings, than ourselves. I have chosen "The Education of a Surgeon under Thomas Vicary" as the subject of the second historical lecture at this College to combat this thought. We owe the lectureship itself to the good will of the Barbers' Company, once our competitors, then our allies, and now our very good friends. I desire to testify publicly to the satisfaction which this evidence of reconciliation excites in the minds of those who know the good historical work done by the late Mr. John Flint South, formerly President of this College, and by the late Mr. Sidney Young, a Past Master of the Worshipful Company of Barbers, work which is still being carried on by Mr. Past Master Weston and other members of the Court of Assistants.

I do not know who decided that the historical lecture should be called The Vicary Lecture, but it was a wise choice, because Vicary, in virtue of his age and position, was foremost amongst that band of pioneer surgeons who, in the reign of Henry VIII, desired to see their calling advanced from a trade to a profession. Their work was not crowned with complete success, but to their labours the surgeon owes in part his present social position in this country.

During the whole of Vicary's life medical education was undergoing changes analogous to those now occurring to which the term reconstruction is applied, and for similar reasons. In many ways the fifteenth century resembled the present time. The Wars of the Roses practically destroyed the old nobility, for attainders and executions altered the ownership of land throughout the country, whilst crushing taxation and the general insecurity hampered trade and materially reduced the wealth of the citizens. It was impossible to do business in London when such thousands of troops were quartered in the neighbourhood or were actually billeted on the citizens that "the Mayor rode daily about the city and the circuit of Holborn and Fleet Street, accompanied by five thousand craftsmen or thereabout, well and sensibly arrayed", to maintain order and prevent looting. From 1450 to 1485 English surgery suffered in the general dislocation of affairs, and no advance was made. The death of Richard on the field of Bosworth, the succession of the Earl of Richmond as King Henry VII, and his marriage with the Lady Elizabeth of York a year later, gave peace to the realm. Then, as now, the surviving generation turned for a time to religion rather than to secular matters. There was a period of church building, church restoration, and the foundation of chantries, in the same spirit which is now leading to the erection of crosses and memorials in churches and villages throughout the country.

Surgeons undoubtedly felt the lean time. London had always supported a small body of surgeons independently of the barbers. These men performed the same duties as ourselves. They undertook the more difficult operations, were called in consultation to obscure cases, and generally considered themselves to be on a higher plane than the barbers. Their practice, however, was somewhat different from our own, for they were

FIG. 162.—THOMAS VICARY.

itinerant; that is to say, when they undertook an operation they stayed with the patient until he was cured, and they seem for the most part to have been attached to the persons of the higher nobility. They charged large fees, because they could only undertake a single case at a time, and might be months before they were released from their attendance. When their lord was called out in the course of war they accompanied him, and thus saw much military service. They received their pay rather in kind than in money, for at the time of which we are speaking Ambroise Paré was paid with a cask of wine, a horse, a diamond, and a promise from a patient that he would never let him want. Such promises were quite numerous, and were usually estimated at their proper value.

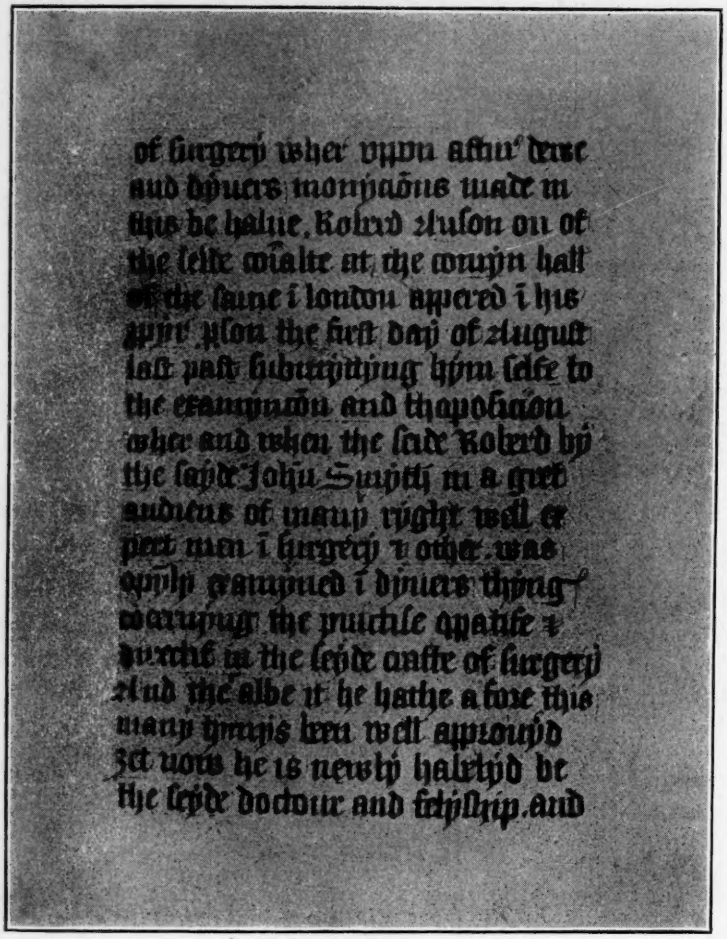


FIG. 163.

During the hundred years' war with France, and during the Lancastrian and Yorkist wars in England, surgeons no doubt made a good but precarious living. With the reign of Henry VII began a long and settled peace, which obliged the surgeons to reconsider their position. The old and wealthy nobility had been destroyed, and they were compelled to turn their attention to the newly-formed middle class as it was represented by the citizens. For this purpose they entered into an agreement with the Barbers' Company in 1493—the eighth year of the reign of King Henry VII—and in this agreement there is a special clause dealing with the examination of surgeons. The licence of Robert Anson is still in existence, and is dated August 8, 1497. It states (*Fig.* 163) that he was examined by "Master John Smyth Doctour in Phesik, Instructour & examenar of the feliship . . . in a gret audiens of many ryght well expert men in surgery & others". Even at this early period, therefore, a special examiner had been appointed to conduct a public examination in surgery. Examination of surgeons, however, was no new thing in the fraternity of surgeons, for it was proposed in the abortive scheme of 1423, which aimed at uniting surgeons and physicians, as well as in the ordinances of 1435, which regulated the gild for many years. It seems, therefore, that the fraternity of surgeons dealt more with the practising surgeon than with the apprentice. It desired to ascertain what a man knew rather than how he had gained his knowledge—in other words, whether he was a reasonably safe practitioner—before he was allowed to practise in the area over which it ruled.

The Company of Barbers, on the other hand, dealt more with the apprentice, for the London gilds, even before they became chartered companies, had always taken an interest in the education of their members, and had endeavoured by a system of apprenticeship to provide satisfactory craftsmen. Provision for teaching and evidence of professional knowledge both before and after admission to the freedom had always been made by the Company of Barbers in London. Elsewhere in England the custom varied. Education was insisted upon when the gild consisted of barbers united with surgeons, as at Norwich, Bristol, and Edinburgh, and when the barber surgeons and physicians worked together, as at York. There was no such demand when the mystery of surgery and barbery was a mere trade, as at Oxford where it was associated with the waferers and makers of singing-bread, or at Newcastle where it was combined with the wax chandlers; but even in these gilds there is evidence that a minimum of professional knowledge was demanded of applicants for the freedom on the surgical side.

The Company of Barbers was formally united with the fraternity of surgeons by the Act of Parliament which received the royal assent on July 25, 1540. Vicary was elected Master of the United Company at the end of John Pen's term of office, and acted in this capacity from September, 1541, to the usual date of election in September, 1542. The Union is commemorated in the well-known picture by Holbein, which has fortunately preserved for us portraits of the chief actors.

The United Company immediately proceeded to consider the state of the profession, and found that there were two problems to be solved—the one internal, the other external. The internal problem was itself twofold, and concerned the better education of the profession; the external problem was the better education of the public to appreciate the proper treatment of surgical disease. The internal problem had already been partially answered, and by combining the customs of the barbers in regard to their apprentices with the regulations of the surgeons in dealing with those licensed to practise, a fairly adequate system of surgical education was evolved. No complete medical education, however, could be given so long as the surgeon was subordinate to the physician. This subordination remained for many years, and the second part of the internal problem could not therefore be solved.

Apprentices.—Very few lists of apprentices to barbers have been published, but it is clear from a study of such of them as exist that the boys were drawn from the lower classes, as the occupation of the father is frequently given as a 'labourer'. There is no evidence to show that the surgeons' apprentices came from a much higher class. A successful surgeon sometimes took his son as apprentice, as in the case of Thomas Gale and his son William Gale; William Clowes and William Clowes junior. The Arris family, to whom we owe the Arris bequest, lasted through three generations. Jasper Arris was a barber as well as a surgeon; Mr. Alderman Edward Arris, his son, was a surgeon and did no barbery; his eldest son Robert followed the grandfather and father as a surgeon, whilst the second son became a doctor of medicine, a Fellow of the Royal College of Physicians, and a Member of Parliament; but then Mr. Alderman Arris was the father of twenty-three children, so he could well afford to give two to the profession of medicine. As a rule, however, the surgical apprentices were drawn from the humblest ranks, and owed any position to which they attained entirely to their own talents. Thomas Gale says in *An Institution of a Chirurgion*, "Few that have wel brought up their sonne will put him to the arte, bicause it is accounted so beggerly and vile". Similar testimony is borne by Sir Humphrey Gilbert as late as 1570 in that curious tract* which foreshadows the present University of London. Writing to Queen Elizabeth about "The erection of an Achademy in London for educacion of her Maiestes Wardes and others the youth of nobility and gentlemen", he says, "The Phisition shall practize to reade Chirurgerie, becawse thorough wante of learning therein we haue verie few good Chirurgions yf any at all. By reason that Chirurgerie is not now to be learned in any other place than in a Barbors shoppe". Here, too, is the

* Brit. Mus. Lansdowne MS. 98.

story of Mr. Thomas Hollier, who was Master of the Company in 1673. He was surgeon at St. Thomas's Hospital, and cut Mr. Pepys for the stone. Indeed, he was so lucky a lithotomist that he cut no less than thirty persons for the stone in one year without a single death. Mr. Pepys was fortunate in coming under him at this time, for his instruments afterwards became septic, and many of the rest of his patients died. I have only lately discovered this contemporary story of his rise. It is told by the Rev. John Ward, Vicar of Stratford-on-Avon, whose commonplace books I am slowly transcribing. He says: "Mr. Holliard, the great Chirurgion in Warwick Lane, was a poor boy in Coventrie, his father was a cobbler, or at best but a poor shoemaker in Coventrie, and one Dr. Mathias (I think he was Queen Anne's Dr.)* about that time frequently coming to Combe Abbey and using Coventrie much spoke to Abraham Ashby an Apotecarie there to help him to a boy to dresse his horses and ride along with him; and Mr. Ashby spoke to Mr. White the Schoolmaster who told him he could help him to one, but his father was a foxing, drunken fellow, and the boy that he helped him to was this Mr. Holliard, the Chirurgion; and afterwards Dr. Mathias died and Mr. Holliard got himself a little money and put himself prentice to Mr. Mullins his father of Shooe Lane and now he comes to what he is." The Mullins, father and son, were surgeons to St. Thomas's Hospital and were also eminent lithotomists.

Apprenticeship.—The first step in the life of an apprentice was the sealing of his indentures and their enrolment at Barber Surgeons' Hall in Monkwell Street and at the Guildhall. For this purpose the boy had to appear before the Court or governing body of the Company to show that he was not deformed or suffering from any chronic disease, for it was a tradition handed down from the earliest days of the gilds that the apprentices should be healthy, and free from blemish or from spot. The opportunity was taken to ascertain that he could at least read and write, and it was hoped that he might have some knowledge of Latin. Latin was taught at this time as a living language in the grammar schools throughout the country, so that a smattering of it might reasonably be expected, and a boy who knew no Latin must have been very badly educated indeed. Accordingly, in 1556, an ordinance was issued that no surgeon should take as an apprentice "but that he can skill of the Latten tongue and understand of the same", under penalty of a fine of forty shillings. It seems, however, to have been impossible to maintain the rule, for it was rescinded the following year, and in 1563 Thomas Gale, dedicating his *Enchiridion of Surgery* "unto the young men of his Companie, studients in the noble art of Chirurgerie", says that he wrote in English "because the books you should use are written in a tongue which the most of you understand not".

At this time the boy was about 14 years old, and if he passed before the Court and his indentures were registered his period of servitude began. It usually lasted for seven years, in which case he would be made free of the Company and could practise on his own account by the time he was twenty-one. The period of apprenticeship, however, might be prolonged for eight or even nine years. The fee paid to the master was at first merely sufficient to cover the expense of clothing and feeding the boy in return for his services. In later years—when apprenticeship carried with it valuable reversions, as in the case of those who were bound to hospital surgeons like Hunter, Abernethy, and Astley Cooper—fees of £500 to £1000, which were then thought to be enormous, were readily paid.

Each master was allowed to take three or four apprentices according to his position in the Company, and if he died the apprentice was 'turned over' to another master or to the widow for the remainder of the term for which he was bound.

The average number of apprentices presented annually at the Barbers' Hall was 150, so that if the indentures lasted seven years there were always about 1000 apprentices belonging to the Barber Surgeons alone, and the other City companies had them in proportion. They were all strong and lusty young men, and a tight hand had to be kept

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* Anne of Denmark, married to James the First of England and Sixth of Scotland.

over them. The Barber Surgeons fortunately had ample disciplinary powers over their apprentices, for they could whip or imprison them, or suit the penalty to the crime, as when they ordered a young dandy's head to be shaved when it was fashionable to wear the hair long.

Surgical Education.—As soon as the United Company had obtained the Act of Parliament in 1540, arrangements were made to provide an improved system of surgical education. Some machinery already existed for the purpose, as the Gild of Surgeons had always taught both its members and apprentices by a system of lectures. Each member of the gild was pledged under a fine of twenty shillings, either to lecture himself or provide an efficient substitute. The lectures must have been oral and, so far as I know, there are no manuscripts or students' copies of them in existence at the present time. Morested, Bradwardyn, Ferris, Keble, and other great surgeons of the fifteenth and sixteenth centuries are thus nothing more than names to us, for they have left no literary remains, though we know from the evidence of their pupils that they exercised a great influence in promoting a higher standard of surgical teaching and ethics. It is probable that their lectures dealt largely with their own experience and with the remedies they found most serviceable.

Anatomy.—Anatomy had always been taught, for it was the basis of surgery, but some far-seeing members of the gild got its teaching regularized by the introduction of the following clause in the Act of 1540: "That the sayd maysters or gouernours of the mistery and comminaltie of barbours and surgeons of London, and their successours yerely for euer after their sa[i]d discrecions at their free liberte and pleasure shal and maie haue and take without contradiction foure persons condempned adiudged and put to deathe for feloni by the due order of the kynges lawe of thys realme for anatomies without any further sute or labour to be made to the kyngs highnes his heyres or successours for the same. And to make incision of the same deade bodies or otherwyse to order the same after their said discrecions at their pleasures for their further and better knowlage instruction insight learnyng and experience in the sayd scyence or facultie of surgery." A supply of bodies was thus insured and the Company at once elaborated a system for putting them to the best use. They appointed a lecturer with the title of Reader of Anatomy, and four stewards or, as they would now be called, demonstrators under him. The Reader of Anatomy seems at first to have held office for an indefinite period, but he was afterwards appointef dor terms of three to five years. The stewards acted for four years; during the first two they learnt their duties, and during the last two they executed them under the direction of the Reader, and were called Masters of Anatomy. Unfortunately there are no extant records of the first few years of the Company's existence, so that it is impossible to discover who was appointed the first Reader of Anatomy. I believe, personally, that it was Master Vicary himself, and that he lectured on the old lines. My predecessors, the surgeons of St. Bartholomew's Hospital, published *The English-mans Treasure. With the true Anatomie of Mans Body*, after his death. There has always been a tradition that it first saw the light in 1543 although it was not printed until 1577. It is a worthless treatise on anatomy based upon the teaching of Lanfranc and Henri de Mondeville, but it shows that Vicary was looked upon as an anatomist by his contemporaries, and the edition of 1543 may have been the text from which he had lectured. Be this as it may, a vacancy for a Reader of Anatomy occurred about 1546, and the Company adopted the wise policy of choosing the best possible man for the post. They elected, no doubt by the advice of Vicary and on the recommendation of Dr. Butts, Dr. John Caius, a Cambridge graduate, aged 36. Caius had lately returned from Italy, where he had been a fellow lodger with Vesalius at Padua and an acquaintance of Realdus Columbus, the two great anatomists of their age. He was also a competent Greek scholar, and had made a special study of Galen, hunting through the great libraries of Italy for accurate texts. In 1544 he issued his edition of the *De Medendi Methodo* and other works of Galen which had not previously been published. No better choice could have been made by a young and virile society which included a large uncultured element amongst its members. Caius was a grave and learned man, a stickler for etiquette, and a bachelor. He lived in the

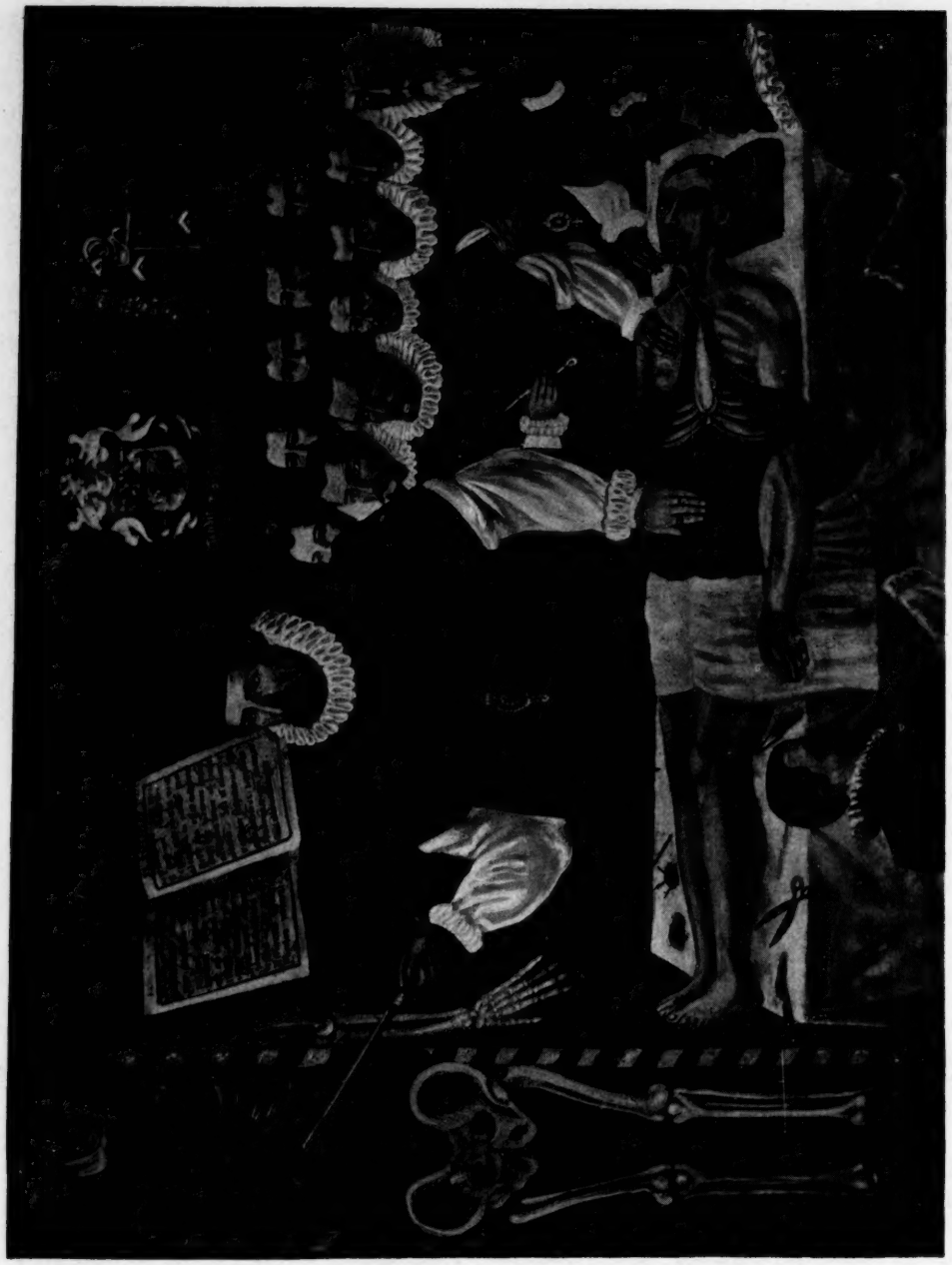

FIG. 164.—John Banester delivering the visceral lecture at the Barber Surgeons Hall, London, in 1581.
By permission of the Wellcome Historical Medical Museum

immediate neighbourhood of the Barber Surgeons' Hall in Monkwell Street, for he had a house in St. Bartholomew's Hospital, and could thus devote sufficient time and energy to his work. He held office until 1563, and was succeeded by Dr. Cunningham. His long tenure of the lectureship left a permanent mark upon the teaching. The Reader of the Anatomy was ever afterwards a young university graduate. The post was well paid, and many of its holders subsequently achieved fame. The Anatomy of Realdus Columbus was long a recognized text-book, and some work of Galen, either the *De Methodo* or the *Therapeuticon*, with a slight knowledge of Hippocrates, was required of every apprentice or surgeon before he was granted the licence of the Company.

It is easy to reconstruct the manner in which anatomy was taught in the sixteenth century, for this picture (*Fig.* 164) is a faithful representation of such a lecture as it was given in the anatomical theatre at the Barber Surgeons' Hall. It shows John Banester delivering the visceral lecture in the year 1581. The two Masters of Anatomy with a probe and scalpel stand beside him, whilst the two stewards are on the opposite side of the table. The minute accuracy of detail is shown by the *vade mecum* which is being used as the text of the lecture, and it will be noticed that the skeleton is supported and crowned with the colours of the Barber Surgeons' arms, whilst a wreath of the same colours surmounts the helmet in Banester's arms. The book on the reading desk is Realdus Columbus, and from its size I thought it must be the folio edition printed at Venice in 1559. Reference to this edition, however, shows that the passage at which the book is open occurs on folios 227 and 228. The picture gives the pages 419 and 420. Looking about for another edition, I found the octavo published at Paris in 1572, and turning to Chapter 5 of Book XI, I discovered the latter part of the passage quoted occurring just as the painter saw it on pages 419 and 420. It shows that Banester had not only chosen the last edition of his text-book to lecture from, but for the convenience of the students he had selected the cheaper and more portable book. Time has dealt gently with Banester, for in addition to the picture of his lecture, there exists in the University Library at Cambridge a casket of wood and leather ornamented with gold and blind tooling, containing the anatomical figure of a man and an ivory skeleton. The inscription on the box (*Fig.* 165) reads

> "Iohan*n*es Ba*n*ister Medicus
> Londinensis, & Anatomicus insignis, Academiæ
> Cantabrigiensi dono dedit cistellulam hanc, unà-
> cum artificioso Sceleto, & exteriorum musculo-
> rum humani corporis Icone, affabrè factis, & in
> eadem contentis. Anno Dom. 1591."

The casket is too fragile to travel, but Dr. Jenkinson, the University Librarian, has kindly allowed me to have it and its contents photographed (*Figs.* 165 and 166).

The subjects were probably chosen with considerable care during their life, as the executions were so numerous that a selection could be made. The material was of the best, as very little physical damage was done at the hanging. The medical students in Vicary's time, therefore, were in a much better position than their successors two hundred years later, who had to resurrect the body, and, in consequence, rarely had an opportunity of seeing the muscles and tissues of the neck, which were always lacerated in the process of exhumation, or by the violence of the long drop. Indeed, so slight was the injury inflicted at Tyburn, and the subjects so often recovered when they were brought to the Hall, that the following order was made on July 13, 1587: "Item yt ys agreed That yf any bodie w^{ch} shall at anie tyme hereafter happen to be brought to o^{r} Hall for the intent to be wrought uppon by Thanatomistes of o^{r} Companie shall revyve or come to lyfe agayne as of late hathe ben seene The charges aboute the same bodie so reviving shall be borne levied and susteyned by such person or persons who shall so happen to bringe home the Bodie. And further shall abide suche order or ffyne as this Howse shall Awarde." After this the subjects do not appear to have come to life again. There was no difficulty at first in obtaining the bodies, but in later years the Company had sometimes

to be assisted by a military guard, so fierce was the resistance offered by the mob at the place of execution.

Bodies being relatively plentiful, they were dissected by systems rather than by regions, a plan which is still customary in the veterinary schools of this country. The viscera were considered first, as being the most perishable, the muscles and arteries next, the bones, ligaments, and joints last. Different benefactors endowed different

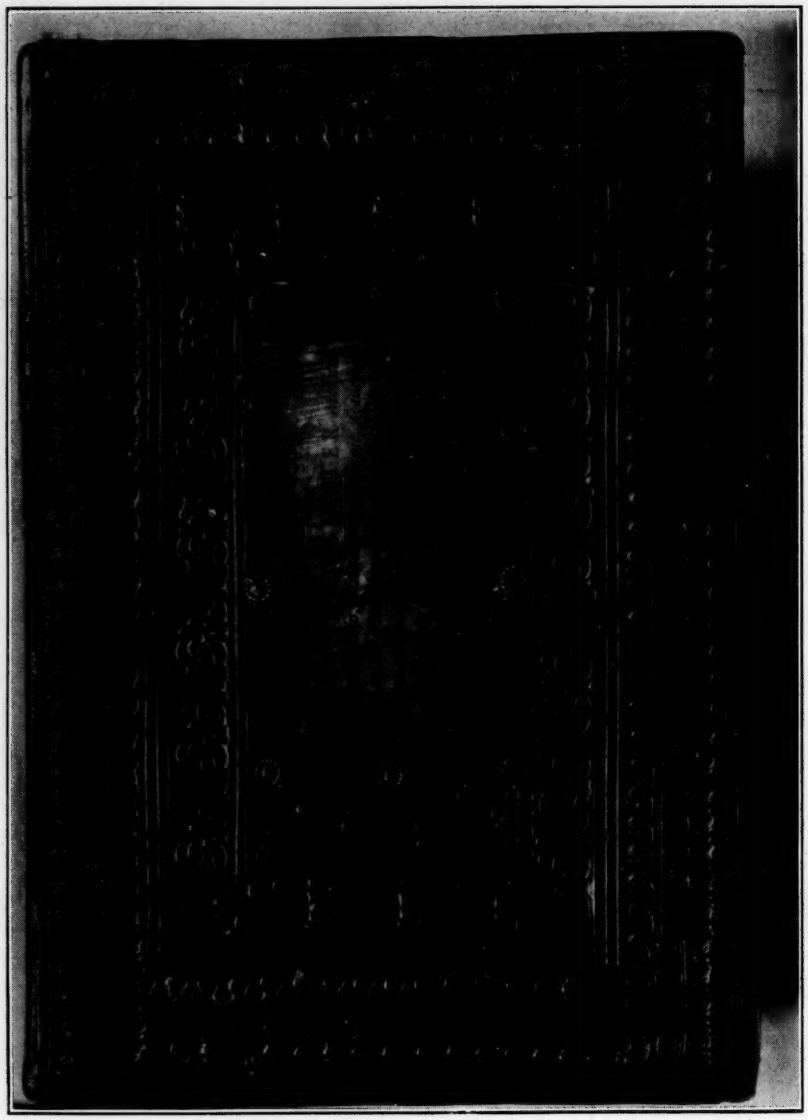

FIG. 165.

lectureships for this purpose, and thus arose a visceral lecture, a muscular lecture, and an osteological lecture. Of these lectureships vestigia still remain in our Arris and Gale lectureship ; the Arris bequest being originally devoted to a muscular and the Gale to an osteological lectureship.

The anatomical teaching was long kept in the hands of the Barbers' and Surgeons' Company as a strict monopoly, and no body could be dissected by any of its members without leave from the Company. Such leave, however, was not unduly withheld when

application was made in a proper manner. Thus there arose two classes of anatomy. The one, called the public anatomy, was the formal dissection of the bodies of the four criminals. It soon became one of the sights of London, and involved the United Company in some expense to provide proper accommodation for the crowds who attended. The second class consisted of private anatomies held as opportunity occurred, or as occasion required, by those who were devoting themselves to anatomy as a study.

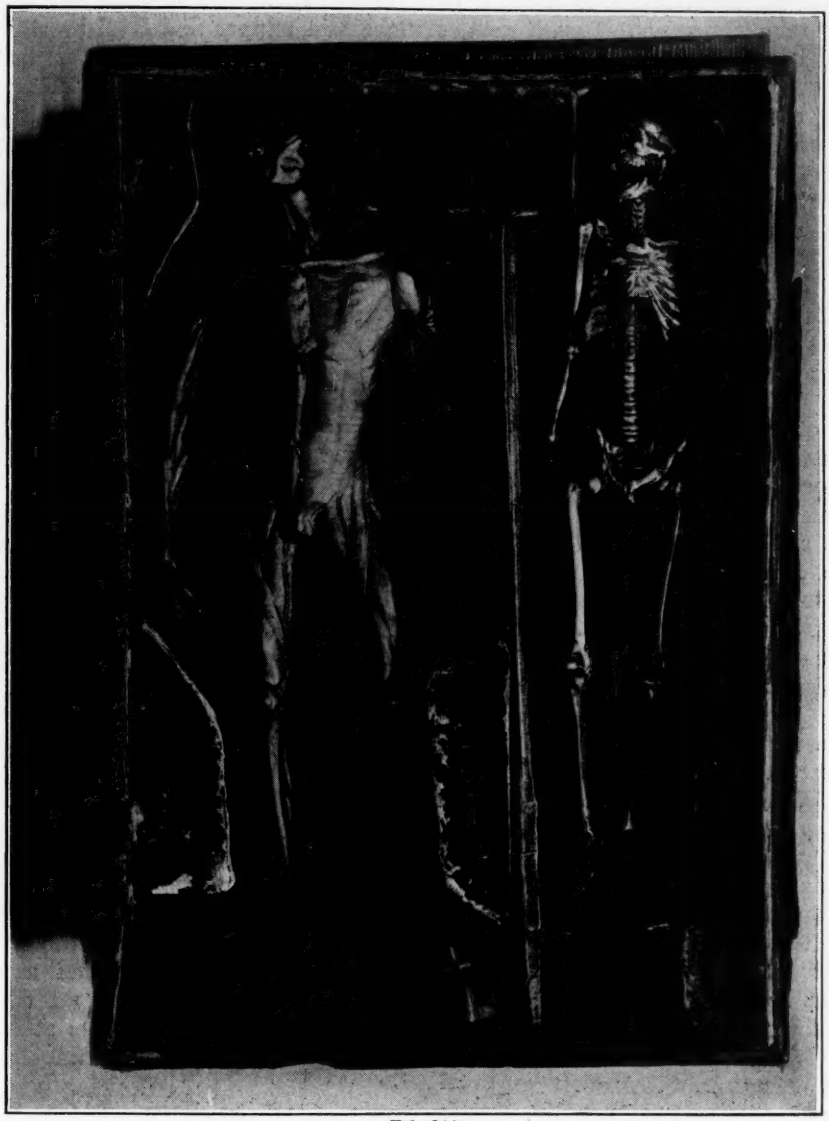

FIG. 166.

Each of the public anatomies lasted for three days, after which for another three days the masters of the anatomy were allowed to teach their pupils, the whole business being ended with a feast, and it was the duty of the two junior stewards of anatomy to see that the tables were properly furnished. The more distinguished visitors attending the dissection were invited to the banquet, and for this hospitality on the part of the Company we are indebted for the account left us by Mr. Pepys, on Feb. 27, 1662–3, of Dr. Scarborough's demonstration of the parts concerned in vesical calculus. For each

of the public anatomies the lecturer received £10 and the masters of anatomy £3 each, the total expense being £22 14s. 6d.

Surgery.—Surgery was taught by a compulsory lecture given every Tuesday afternoon throughout the year; Tuesday being chosen because it was the day on which the Court of Assistants, or, as we should say, the Council, held its ordinary meeting. The earlier apprentices and surgeons of the United Company were fortunate in their teachers. Caius was the lecturer on anatomy; Gale (*Fig.* 168), Clowes, Halle (*Fig.* 169), and Balthrop taught surgery. Rough men, of uncertain temper and with much mother wit, they had been trained in the wars, were attached to large hospitals, and had the chief surgical practice in London. They quarrelled violently, fought each other with their fists, and sometimes promised to cure patients who were incurable, for which they were duly reprimanded by the Company and made to refund the fee. But in their writings at any rate they speak kindly of each other, and wrote verses to recommend each other's books. They were in truth a band united, as I shall show presently, with the common object of raising the status of surgery.

The lectures were arranged in courses, each course being given in turn, the 'auncientist Surgeon' beginning, and the others in due order following. As in the case of anatomy, the lectures took the form of a running commentary upon a text-book, the text-book being either one in traditional use, like Guydo's *Questions*, which had been translated into English, or the *Surgery* of Tagaultius, which was in Latin, or it might be one written by the lecturer himself. Gui and Tagaultius were respectively the 'Rose and Carless' and the 'Gask and Wilson' of the day. I have read both. They really contain a great deal of sound and useful surgery if they are considered in the light of contemporary knowledge. A part of the course was devoted to bandages, the recognition of surgical instruments, and the use of such drugs and external applications as were allowed the surgeons by the physicians.

Lapse of years removed this brilliant band of surgeons, and no worthy successors were forthcoming. The Company made repeated appeals to the surgical members, and tried to make them lecture, or in default pay a fine. They preferred to pay the fine, until, at last, in desperation, a paid lecturer on surgery was appointed, and the surgeons were ordered to find his salary of £20 a year out of their own pockets. I show you here the surgical text-books of the time. In addition to Gui and Tagaultius, which I have just mentioned, they are Oribasius; Halle's edition of Lanfranc; Gale's *Surgery* and translations of Galen; several works of Clowes; Banester's *Treatise on Ulcers*; Bullen's *Dialogues*; Valerius Cordus for drugs; and Realdus Columbus for anatomy.

Pathology.—Pathology was sometimes allotted to the lecturer on anatomy and was sometimes a part of the surgical course. Inflammation and its results, and the various kinds of tumours, were common to each course. In the hands of the anatomist—because he was a physician—various treatises of Galen and a little Hippocrates were also dwelt upon; the surgeons, less learned and knowing no Greek, either had the Latin versions translated into English, or, as is more likely, curtailed this portion of the course to the great advantage of their audience, for the matter was both dry and useless. It is somewhat remarkable that no attempt was made to teach by clinical examination; indeed, there is some evidence to show that the introduction of patients at lectures was definitely forbidden. It was not until 1602 that a clinical examination was first required, and then it was in Scotland.

Examination.—The United Company elaborated their system of examination with considerable care. No one could practise surgery in the city of London or within a radius of seven miles without their licence, and it was decided that examination was the best means of determining a man's fitness to practise. Two classes of candidates presented themselves: (i) their own apprentices, and (ii) surgeons who had been in practice elsewhere —foreigners as they were called technically—and who wished to settle in London. The first step of the United Company, therefore, was to appoint eight examiners, the number being afterwards increased to ten—freemen of the Company, of course, but not necessarily of the Assistance or Council. Four of these examiners undertook the examination of candidates in the presence of the Master and Wardens of the Company, who might, of

course, be barbers, knowing nothing of surgery. Upon the report of the examiners the Master, Wardens, and Court of Assistants granted the licence, or preferment of grace as it was called.

We have a clear picture of the method of procedure. As soon as the apprentice was out of his indentures he presented himself at the Hall in Monkwell Street with a recommendation from his Master. Ushered into the Hall (*Fig.* 167), he was asked by the Master and Wardens what he intended to do after he was made free of the Company. If he replied that he proposed to practise surgery, he was asked whether he meant to settle in London. If he said, "That is my intention," he was sent over to the examiners, of whom four were always present, and they proceeded to test his knowledge. They asked him in English about anatomy and surgery; of what parts they consisted; what were the bones, their number in different parts of the body, how they were moved; where the large vessels ran; what was the use of the liver, the spleen, and brain; in surgery and pathology what were the tumours *præter naturam*, how he would treat an apostume or inflammation, what should be done for the bite of a mad dog, what were the causes of blood

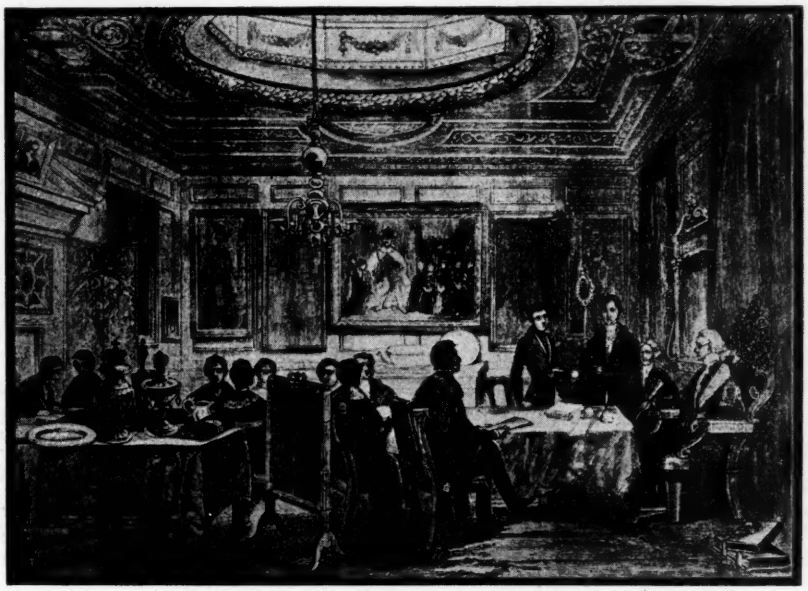

FIG. 167

in the water, what was a struma, and so on. If his answers proved satisfactory—and they did not always prove so—he was licensed to practise surgery for a term of years varying with the knowledge he had shown, and was admitted a freeman of the Company.

In the early days, of which alone I am now speaking, he was advised at the same time to proceed to the higher degree of Master of Anatomy and Surgery—the second preferment of grace—and was told that he could do so either by writing an Epistle, i.e., a thesis to be read before the Company every six months; or, if he were not gifted with the pen of a ready writer, he might be examined half-yearly to determine what improvement he had made in practice. If the candidate were then approved, he was formally admitted a Master of Surgery and Anatomy, which was a permanent licence to practise, and allowed him to apply to the Bishop of London for the Bishop's licence, which "is said to be confirmation of a Surgeon". Few, however, took the second step, and it seems to have quickly fallen into disuse, its place being taken by 'the Great Diploma', granted after a special examination to those who aspired to the highest surgical position. It was somewhat analogous to our Fellowship examination.

The cost of the licence was viiid.; the cost of the Mastership was a spoon weighing an ounce of silver, with the applicant's name written upon it, as a present to the Company, and viiid. to the clerk for enrolling the name.

Rejections were not infrequent, but it was more usual to grant an ignorant man a temporary licence, either for a short time or on condition that he should call in some more experienced member of the Company whenever he had to treat a patient. Occasionally the candidate was so shockingly bad that the coroner was invited to hear the examination—a good practical way of saving subsequent inquests. Here is an example: "One John ffoster a poore and unskylfull man of this Company made his appearance before the Mrs. of this Company and was examined concerninge his skyll in the arte of Surgery and was found altogether unskilfull in all the partes thereof. Whereuppon it is ordered that Mr. Wilbraham, Coroner to this Cytie, be warned to be here with the Coroner's Inquest on Thursdaye next by tenne of the clock in the forenoone to be satisfied by their owne hereinge of the unskilfullness of the said ffoster."

When the apprentice said that he did not intend to practise in London or the suburbs, he was admitted to the freedom of the Company without examination, and went his way to get the licence required in the district where he settled, whilst he had the added dignity of having been educated in London.

It was also possible for a surgeon to obtain a licence to practise even though he had not served an apprenticeship to a freeman of the Company. Such licences were often granted to pleasure some great man and upon his personal application. It was productive of much harm, and detracted from the reputation of the Company when the Master and Wardens were mercenary, or when the Company was in financial straits, as frequently happened, for unworthy men were then admitted. John Read, of Gloucester, took the Company to task for this fault. He says many do "practise abroad their accustomed deceipts under the colour of admittance from the Hall of London. . . . A thing greatly to be lamented that those which are or should be the fathers of arte and upholders of good artists should so slightly passe their licence to such ignoraunt asses, to maintaine them, not onely in coosening her Majesties subjects of their monie, but oftentimes depriue them of their lims, yea and also their lives. But it is no meruaile for monie is sweete, and what is it but Lucre may doe? for I myselfe, talking with one of the same companie and felowship, complayning uppon the abuses thereof, in passing their licences to such, made me this answere. In deed, quoth he, it is not well, but we were as good to take their monie for they would play the knaves nevertheles . . . I know someone of small learning and lesse knowledge, who hauing trauelled 180 miles to fetch a seale weying fower pound besides the apurtenances therunto belonging, whereby he is growen so farre in love with himself and so undiscretlie doteth ouer his owne doings at his returne that he maketh his travel, and conquest as he thinketh, ordinary table talke, for he walked from Tauerne to Tauerne and from Alehouse to Alehouse with his licence at his girdle closed in a boxe, as though he had been the proctor of some spitell house agrauating the latter so monstrouslie, as if he had endured the verie labours of olde Hercules, and no meruaile, for when he had made his market, and receaued his letters of marke, falling in companie with some others, and grewe in speeches of practise (for there uppon he standeth, but his method is small) did not stick to confirm that Arsenick and rusty Bacon, was a present remedie for wounds made with goon-shot. And being another time demaunded by a learned Doctor in Phisicke how a wound came to be an ulcer was stricken dum. And yet of like he might aunswere his examinations well. For that (as he saith) he was used so familiarly and plast amongest the best. A meane surely to embolden him well for he was but bashfull when he was before the worshipfull Doctor. And yet will not stick to make himselfe comparable to any and will impudentlie cracke, that any man shal neuer attaine to do the like cures as he hath don, with a great deal more of shamles comparisons."

The possession of a licence did not relieve its holder from what would now be called post-graduate teaching. Under penalty of a fine the members of the Company, including the Master and Wardens, were obliged to attend the demonstrations in anatomy and the lectures on surgery, exemptions being only rarely granted. They had not only

to attend, but for the honour of the Company they had to come properly dressed, they were bound to remain the whole time, and were enjoined not to ask questions until the lecture was ended, when they might courteously point out anything which they thought had been taught incorrectly.

Presentation of Cases in Peril of Death or Maim.—From time immemorial there was a most salutary custom of consultation in all serious surgical cases. This was known as " the presentation of patients in peril of death or maim ". It applied equally to the oldest practising surgeon and to the one most recently licensed. It provided that everyone who was called in to treat a patient likely to die, or who might afterwards be permanently incapacitated, should summon to his assistance the Master and Wardens, originally of the Gild of Surgeons, later of the United Company, after which the surgeon in attendance was held blameless for anything that might happen. The consultation was held before the third dressing of the patient, practically before the third day. It was jealously enforced, for there are numerous instances of surgeons being fined, sent to prison, and even struck off the roll, for not presenting their cures 'in peril of death or maim'. In the United Company, where the Master or Wardens might be barbers not practising surgery, a surgeon or surgeons could be nominated to act in their place. The work on their part was gratuitous, but provision was made that in case any recompense was offered it should be equally divided amongst them. The system worked satisfactorily, for it applied impartially, gave confidence to the friends of the patient that everything possible had been done, relieved the surgeon of responsibility in a very litigious age, and gave the senior members of the Company a large experience in difficult cases. Incidentally it shows how small must have been the population of London and seven miles round when the Master and Wardens, who were themselves in practice, could undertake such additional labour under the penalty of a fine for not attending when called upon to do so.

Education of the Public to Appreciate Surgery.—The education of the public to appreciate the value of better surgical treatment proved to be a more difficult task than the education of the surgeon himself. Surgery had reached a very low ebb at the beginning of the sixteenth century, for in 1511 an Act of Parliament for the appointing of physicians and surgeons recites that " the science and cunning of Physic and Surgery is daily within this Realm exercised by a great multitude of ignorant persons of whom the greater part have no insight in the same nor in any other kind of learning. Some also can no letters from the Book, so far forth that common Artificers as Smiths, Weavers and Women boldly and accustomably take upon them great Cures . . . to the great infamy of the Faculty and the greivous Hurt, damage and destruction of the King's Liege people most especially of them that cannot discern the uncunning from the cunning ". This is confirmed by Clowes some years later, who says " that many in these days do take upon them to intermeddle and practise in this art, wherein they were never trained nor had any experience ; of the which a gret number be shameless in countenance, lewd in disposition and brutish in judgement, which do forsake their honest trade whereunto God hath called them and do daily rush into physic and surgery. And some of them be Painters, some Glaziers, some Tailors, some Weavers, some Joiners, some Cutlers, some Cooks, some Bakers and some Chandlers. Yea, now-a-days it is apparent to see how Tinkers, Tooth-drawers, Pedlars, Ostlers, Carters, Porters, Horse-gelders and Horse-leeches, Idiots, Apple-squires, Broom-men, Bawds, Witches, Conjurors, Sooth-sayers, and Sow-gelders, Rogues, Rat-catchers, Runagates and Proctors of Spittle houses with such other like rotten and stinking weeds which do in Town and country, without order, honesty or skill, daily abuse both physic and surgery, having no more perseverance, reason or knowledge in this art than hath a goose, and most commonly useth one remedy for all diseases and one way of curing to all persons both old and young, men, women and children which is as possible to be performed or to be true as for a shoe-maker with one last to make a shoe to fit for every man's foot and this is one principal cause that so many perish ". The state of surgery indeed was nearly such as to warrant the advice given to a surgeon by William of Salicet in 1275, that " a wise surgeon will do well to refrain from stealing anything while he is actually in attendance and will not employ notoriously bad

characters as his assistants because such actions are apt to lessen the confidence of the patient and may thus spoil an otherwise good operation ".

It is clear that the whole country was overrun by quacks, for we have accounts of their doings in London, Maidstone, and Gloucester, which are now merely amusing, but were then of serious importance. Take a single example from each town. Gale (*Fig.* 168) says: "In the year 1562 I did see in the 2 Hospitals of London, called St. Thomas's Hospital and St. Bartholomew's Hospital, to the number of 300 and odd poor people that were diseased of sore legs, sore arms, feet and hands with other

FIG. 168.

parts of the body so sore infected that one hundred and twenty of them could never be recovered without loss of a leg or an arm, a foot or a hand, fingers or toes, or else their limbs crooked so that they were either maimed or else undone for ever. All these were brought to this mischief by witches, by women, by counterfeit javils that took upon them to use the art of surgery, not only robbing them of their money but of their limbs and perpetual health. And I, and certain others, diligently examining these poor people how they came by their greivous hurts and who were their chirurgions that looked unto them, and they confessed that they were either witches which did promise by charms to make them whole, or else some women which would make them whole with herbs and

such like things, or else some vagabound javil which runneth from one country to another promising unto them health only to deceive them of their money. But what manner of cures they did I have told you, such cures as maketh the devil in hell to dance for joy to see the poor members of Jesus Christ so miserably tormented ".

This state of affairs in London is borne out by Clowes, who mentions that he had amputated seven arms and legs in a morning at St. Bartholomew's Hospital. This statement was not made boastingly, but incidentally as showing a part of his routine work.

FIG. 169.—John Halle.

It was no better in Kent, for Master John Halle (*Fig.* 169) of Maidstone reports that in 1562 there came " one William, a shoe-maker, pretending to be very cunning in curing of diseases of the eyes ; and being brought to a friend of myne to have his judgement in one eye, whereof the sight was weake ; first putting them in much fear of the eye he at length promised to doe great thinges therto. But the friends of the party diseased desired me first to talke with him to understande his cunning ; which, at their request, I did at a time appointed and asked him if he understoode what was the cause of her infirmitie. He said he could not tel but he wold heale her he doubted not. Then I asked him whether he were a surgion or a physitien ; he answerd no he was a shoe-maker

but he could heale all manner of sore eyes. I asked him where he learned that; he sayde that was no matter. Well, sayde I, seyng that you can heale sore eyes what is an eye? Whereof is it made? Of what members or parts is it composed? And he sayde he knewe not that.

"Then I asked hym if he were worthy to be a shoe-maker or to be so called that knewe not howe or wherof a shoe was made? He answered, no, he was not worthy. Then, sayde I, how dare you worke on such a precious and intricate member of man as is the eye, seyng you knowe not the nature therof? and why or by what reason it doth see more than a man's nose or his hande? He answered that though he could not tell this yet could he heale all maner of sore eyes. And that whereas maister Luke of London hath a great name of curyng eyes he coulde do that which maister Luke coulde not doe nor turne his hande to. Thus bragged this proud varlette against and above that reverent man of knowne learning and experience.

"And I sayde, I thought so, for Maister Luke, sayde I, is no shoe-maker. Well, sayde he, I perceive you do but skorne me and flunge out of the doores in a great fume and could not be caused to tary and drynke by any intreaty neither have I since that tyme heard anythyng of hym".

The same story comes from Gloucester, where, as it was near a seaport, there were foreign, as well as indigenous, rogues to contend with. For example: Read tells us that "there came a flemming into the cittie of Gloceter named Woolfgange Frolicke, and there hanging forth his picture, his flagges, his instruments and his letters of marte with long labels, great tossels, broad seales closed in boxes, with such counterfeit showes and knackes of knaverie cosening the people of their monie without either learning or knowledge, and yet for money got him a license to practise at Bristowe (Bristol). But when he came to Glocester & being called before some being in aucthoritie by my selfe & others, he was not able to aunser to any one poynt in Chirurgerie, which being perceived and the man knowen the matter was excused by way of Charitie to be good to straungers".

This attitude of tolerance towards quacks was the root of the evil, and it was so general that in 1542 (34–35 H. 8. Ch. 8) a Bill was promoted in Parliament "that persons being no common surgeons may minister Medicines notwithstanding the Statute". The Bill passed, and it "ordained, established and enacted that at all time from henceforth it shall be lawful to every person being the King's subject, having knowledge and experience of the nature of herbs, roots and waters by speculation or practise to use and minister them to their cunning". This opened the door very widely to unlicensed practitioners, for the position of the surgeons was not safeguarded in any way, not even as Guthrie suggested many years later (April 29, 1834), that a quack should be allowed to practise if he took out an annual licence, and should be punishable for ignorance as well as negligence, whilst a duly qualified practitioner should not be required to renew his licence annually and should only be punishable for negligence.

Lack of Medical Education.—Surgery in England had always been subservient to physic, and in this subordinate position it was destined to remain until our own times. The physicians, oppressed by the weight of tradition, were bound by the fetters of the various sects which arose successively in medicine. They only made very slow advances in practice, and their progress was actually retarded by the interposition of the apothecaries between themselves and their patients.

The surgeons, on the other hand, were necessarily brought face to face with the same problems which confront us to-day. When should wounds be closed? When must they be left open? Was it safe to leave a head injury untreated, or should it be operated upon? What was best to be done for the injuries which daily presented themselves as a result of trade accidents, or the disputes which were of constant occurrence in mediæval towns where everyone went armed and passions were easily inflamed. Readiness of resource, mother-wit, and a fair average of manipulative skill were characteristics of the Tudor surgeon, and he trepanned the head, opened the chest, cut for stone, and amputated with remarkable success. He also had some knowledge of herbs and simples, and

there had been handed down to him an antidotary or collection of prescriptions which had proved useful to his predecessors. But of medicine he had no knowledge. All that he did was empirical, and he was in complete ignorance of what would now be called the Institutes of Medicine even as they were then understood.

The result is interesting. There arose for a generation or two excellent surgeons who wrote well in their native tongue and were able to record their experiences. Their books are still worth reading, but they are one and all records of individual cases. No attempt is made to generalize from the results obtained even when the writer could collect from his own observation several similar cases or even whole groups of cases. I suppose we have all passed through this stage when as young men we were proud to publish a single case in one of the medical journals; but as we gained greater experience we cared less for individual facts and thought more of the conclusions we were able to deduce from the correlation of them.

The Tudor surgeons were arrested at the earlier stage, and it was not until a century later that Wiseman began to generalize on his own experience. The absence of this faculty of generalization was, I think, felt instinctively by the great Elizabethan surgeons. They knew that something was wanting in their education, and they believed that if their pupils could be taught medicine as they had learnt surgery, they would be the better for it. Gale says: "Young men should take counsel as well of the learned physician as of the learned surgeon, for this art is so joined together that neither may the parts be divided neither yet the instruments without the overthrow and destruction of the whole art". And in the same way Read says: "I do withall affirm that all chirurgeons ought to be seen in physic, and chirurgery is divided from physic not without great hurt unto mankind". I have no doubt that if the physicians had allowed the surgeons to be taught some medicine they would have been the better for it, and their social position would have been improved, but it is very doubtful whether surgery as a whole would have derived any benefit. Medicine itself was nebulous so long as it was based on speculation rather than on observation, and its teaching at this time would probably have reduced surgery from practice to theory. Gale, like Halle and Banester, puts the position quite temperately when he says, "To counsel with a physician being a grave and learned man in the principles of this art—in matters of weight—I take it to be very necessary; for what is he that is wise that will refuse the counsel of a wise and learned man, and especially of him that possesseth the principles of the same art? For physiologia, whereof the physician taketh his name, is the first and chiefest part which he that worketh in the art of medicine doth prove for that it doth consist in the knowledge of the several natural things, and in the residue thereto appertaining. But yet this doth not follow that a learned and expert chirurgeon should not use diet and purgations and other inward medicines at all times when need doth require".

John Banester writes in the same strain but somewhat more rhetorically: "Some of late more precise than wise have fondly affirmed, foolishly feigned and frantically faced, that the chirurgeon hath not to deal in physic. Small courtesy is it to break faithful friendship or at-one-ment, but it is mad dotage to part that which cannot be separated. How can physic be praised and surgery discommended? Can any man despise surgery and not defame physic? No, sure, he that speaketh evil of the one slaundereth both, and he that robbeth the one spoileth the other. For though they be at this time made two distinct arts and the artists severally named, yet sure the one cannot work without some aid from the other, nor the other practise without the aid of both". So, again, John Read—a much younger man and John Banester's son-in-law—claimed that "Chirurgery is maimed and utterly unperfect without the help of those other parts—which consisteth of prescribing inward medicines and convenient diet, and is so near linked with these in alliance that no man deserves to be called a chirurgeon that is ignorant in physic . . . and I do withal affirm that chirurgeons ought to be seen (i.e. examined) in physic, and that the Barber's craft ought not to be termed chirurgery".

Nothing, however, came of this well-intentioned advice. The surgeons remained on

a lower plane, and when the reformers died—first Read, then Gale, followed in due course by Clowes and Banester—no successors, with the exception of Woodall, carried on their work in England under James and Charles.

Thus ends the second Vicary historical lecture. I have tried to show how much the education of a surgeon owes to the wise counsel of a few great men in those critical times, when the fraternity of surgeons could no longer continue along the traditional lines and there was a real danger of surgery passing into the hands of a trade gild. The example set in London was quickly followed in the provinces, and, within a few years of the establishment of the United Company of Barbers and Surgeons, the large towns of England had remodelled their Barbers' Gilds, and had often followed the example of the United Company in the most minute detail. In due course surgery outgrew the need for a union with the barbers, and in 1745 a dissolution of the partnership took place. The disastrous history of the Surgeons' Company showed how useful the alliance with the Barbers had been to the surgeons. The barbers were business men, the surgeons were thoroughly unbusinesslike. The Clerk of the Surgeons' Company defaulted and left the Company penniless; their building became ruinous; their library contained no books; and, finally, by sheer ignorance of their own Constitution, the Company destroyed itself after an inglorious career of forty years. By its supineness and by its tactless methods a host of enemies had been raised up—and it became impossible to establish the bankrupt Company on the old lines. The present College rose, indeed, upon its ruins; but, because we are now flourishing, do not let us forget how much we owe to the Company of Barbers, our business partners for more than two hundred years, and we shall then understand that the Union of Barbers and Surgeons was not so incongruous or so useless as it at first sight appears.

CLINICAL TYPES OF BAGHDAD BOIL (CUTANEOUS LEISHMANIASIS).

By ZACHARY COPE, London.

Baghdad boil is one of the many popular terms which have been applied to the lesion which results from infection of the cutaneous tissues with those minute organisms, the Leishman-Donovan bodies. Other regional names given to it are Aleppo button, Basra date-mark, and (in India) Frontier sore, whilst the more general terms Oriental sore and

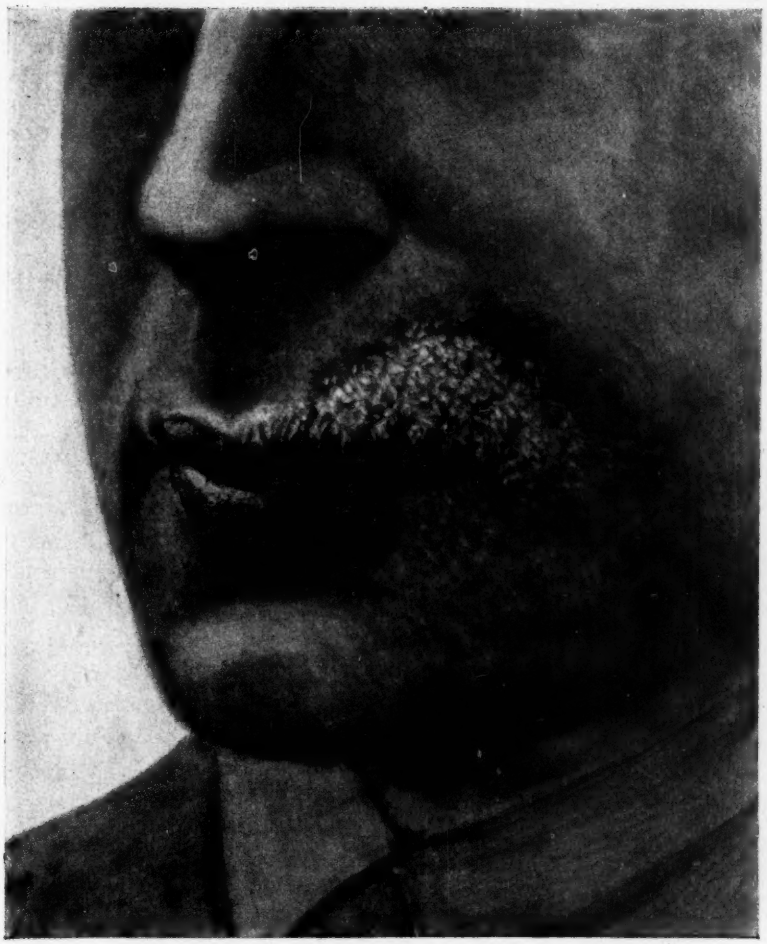

Fig. 170.—Case of cutaneous Leishmaniasis of lupoid type affecting upper lip. The white area is covered by dry epithelial scales. Cured by a few intravenous injections of 1 per cent tartar emetic. Patient caught the disease in Persia.

Tropical sore are also in use. The disease is common in Asia Minor, Syria, Mesopotamia, India, Persia, and East Africa, but in view of its long duration many travellers from those regions to this country are still subject to the disease when they arrive here. Since the affection may simulate closely some common conditions, and inasmuch as I have already

seen serious mistakes in diagnosis and treatment, a note as to the clinical varieties may prove useful.

Infection usually occurs in the most exposed parts—face (*Fig.* 170), hands, or forearms—and is almost certainly transmitted by the bite of a sandfly or mosquito. Multiple lesions are common. Experimentally, it has been shown by Wenyon that the duration from the time of inoculation of infective material to the appearance of the lesion may be as long as six months, though usually the period is, no doubt, much shorter. Sometimes what appears to be an ordinary insect bite does not subside in the usual manner, but passes gradually into a more extensive lesion from which the Leishman bodies can be obtained. I have known a man bitten during one night in more than a dozen places and at the site of each bite there developed a Baghdad boil.

No age is immune, but one attack seems to immunize. In Baghdad most of the children suffer from the affection during the first ten years of life. Adults who enter a region where the condition is endemic frequently develop a lesion. In a unit of about 140 adults to which I was attached, at least 26 developed a Baghdad boil within the year and a half we were stationed there.

If left to itself the disease runs a benign course, resulting in healing in anything from six months to a year. A scar is usually left, which may be very ugly if on the face. Readers of *Hajji Baba* will remember how he " was attacked by a disorder from which few residents, as well as strangers, at Baghdad are exempt, which, terminating by a large pimple, as it dries up, leaves an indelible mark on the skin. To my great mortification it broke out upon the middle of my right cheek, immediately upon the confines of the beard, and there left its baleful print ". The cheeks of great numbers of the residents in Baghdad bear testimony to a previous inoculation with the Leishman-Donovan body.

CLINICAL TYPES.

According to the stage of the disease, the amount of tissue reaction, and the occurrence of ulceration and secondary infection, various appearances are presented. The same lesion may simulate various conditions at different stages of its course. The following clinical types can be recognized: the papule, the rounded ulcer, psoriaform, lupoid, syphiloid, epithelioma-like.

FIG. 171.—Baghdad boils on legs. Common rounded ulcer type.

The Papule.—Commonly the lesion starts as a painless papule, rounded and smooth-topped, and perhaps a little scaly. This may persist for several months, and if it occurs in a person past middle age may very closely simulate a rodent ulcer or papilloma. In course of time it will either retrogress or pass into one of the other types.

Rounded Ulcer.—This is the lesion usually figured and described as the typical Oriental sore (*Fig.* 171). The ulcer is circular, and may be anything up to two inches across; it has a definite raised edge on which the epithelium is intact. The ulcerated surface is generally irregular and covered with flabby granulations on which patches of yellow exudation can be seen. The exudation may dry and form crusts. In the healing stage the granulations become redder, healthy-looking, and cleaner, and gradually become covered with epithelium.

Psoriaform.—The elbow is quite a common place for cutaneous Leishmaniasis, and here as well as in other parts the lesion may take the form of a small red area covered with scales. Such a lesion may at first easily simulate and be mistaken for a patch of psoriasis, though the further course will serve to differentiate.

Lupoid and Syphiloid.—Not infrequently the cutaneous infection may take the form of an area of infiltration with ulcerated patches covered by scabs. Such a condition

bears a superficial resemblance to lupus and tertiary syphilis. The development of the lesion is more slow than that due to syphilis, and more quick than that of lupus. There are no 'apple-jelly nodules' seen on pressing with a glass slide, as in the case of lupus.*

The resemblance to a tertiary syphilitic lesion is often close. I have seen cutaneous Leishmaniasis mistaken for tertiary syphilis by very competent observers, and I have made the reverse mistake myself on clinical grounds in a case where pathological investigation and the result of treatment proved the case to be syphilitic.

Epithelioma-like.—It is rarely that an epithelioma is simulated by a Baghdad boil or by any Leishman-Donovan infection. In some cases, however, epithelioma or rodent ulcer may be imitated by the flat indurated papule or by the ulcer with thick raised edges. This resemblance is all the more significant and misleading in view of Macadam's recent note in this JOURNAL on the histological resemblances of Oriental sore to epithelioma.

DIAGNOSIS.

In diagnosing any granuloma or chronic cutaneous lesion in a patient who has recently (i.e., within six to twelve months) been in countries where cutaneous Leishmaniasis is endemic, the possibility of that lesion must be entertained. During the past year I have had several such cases, one of which had been treated ineffectually for eighteen months, and which healed within a month under correct treatment (*Fig.* 172).

Diagnosis is usually fairly easy by a microscopic examination of a small portion of tissue from the infiltrated edge of the lesion. It is well not to rest satisfied with one negative examination if the condition at all resembles Leishmaniasis. A positive Wassermann reaction does not prove that the lesion is syphilitic, for syphilis may but aggravate the condition.

FIG. 172.—Case of cutaneous Leishmaniasis affecting region of right thigh, groin, and lower abdomen. Treated in England for eighteen months by attempted excision, etc. Taken by several competent observers (of non-tropical experience) to be syphilis. Cured by a month's course of intravenous injections of tartar emetic.

TREATMENT.

There are many methods of treating cutaneous Leishmaniasis, but only one specific cure. Various ointments have been recommended (methylene blue, calomel, etc.); the surgical method of excision and the less satisfactory method of scraping have been advocated; and application of solid potassium permanganate or of carbon-dioxide snow, to burn or freeze the sore away, has found favour with some. The exposure to *x* rays certainly cures in many cases. A few exposures for about three minutes to rays from a rather soft tube has often cured.

But in large ulcers, or in cases where other methods are slow or ineffectual, and especially in ulcers or disfiguring lesions on the face, the best method is to use the specific cure, i.e., tartar emetic. The drug is best administered as a 1 per cent solution intravenously. Starting with 5 c.c. of the sterilized solution, one continues with doses of 7·5 c.c. at intervals of four to seven days, till the sore changes its character and becomes an obviously healing ulcer with no infiltration of the edges. One or two doses may cure, but in the case mentioned above, which had been treated unsuccessfully by excision and other measures, it took eight doses to cure.

* The resemblance to lupus was noted by LEWIS and CUNNINGHAM in 1872.

AN EXPERIMENTAL INVESTIGATION OF THE RESULTS OF LINEAR DIVISION OF THE PYLORIC SPHINCTER.

By CHARLES A. PANNETT, London.

A simple division of the pyloric sphincter muscle (Rammstedt's operation) is now the established method of treatment in congenital hypertrophic stenosis of the pylorus of infants. It is an operation which can be performed in a short time, is followed by but little shock, and the results are better than those after the much more formidable gastro-jejunostomy. Moreover, these results are permanent. The belief that a division of the muscular wall of any part of the gastro-intestinal tract which leaves a gaping wound filled only by the protruding mucosa could be a practical and well-advised measure to take, was at first difficult to adopt, so hazardous and contrary to the accepted methods of intestinal surgery did it seem. But after my first personal experience of its success in a case of congenital hypertrophic stenosis, the question of the applicability of the operation to other diseases of the stomach immediately obtruded itself, and the present inquiry was instituted to determine the immediate and remote effects upon the normal stomach of a division of the pyloric sphincter without injury to the mucosa, in cats.

Method Employed.—After preliminary trials, three operations were performed, one on a male and two on female cats. After an all-night fast to ensure that the stomach should be empty, the animals were given a meal of boiled pounded fish mixed with barium sulphate to make it opaque. Skiagrams of the passage of this meal from the stomach were taken before and after operation. The animals required some training before successful photographs could be taken with the only apparatus then at my disposal, an instrument with which a 4 to 5 seconds' exposure was necessary. They were inclined to start when the noise of the sparking coil or tube was heard. But it was found possible to teach the two female cats to remain quiet and undisturbed. The negatives from the male cat were all unsatisfactory; it was a far less tractable animal. At the operation an incision about half an inch long was made on the anterior aspect of the pyloric sphincter, encroaching, of course, on to the stomach and duodenum at each end. The omentum was then pulled up and sutured to the neighbouring muscle to protect the exposed mucosa. The abdomen was closed, sutures of plain catgut being used for the abdominal wall and skin. All the wounds healed by first intention, and the sutures were allowed to become absorbed spontaneously.

The Anatomical Effects.—The animals were killed 7, 14, and 18 weeks after operation. Post mortem, in all three there were no adhesions except that of the omentum to the site of operation, and these were separable easily. The cat killed 7 weeks after operation showed a simple linear scar, and histological examination revealed the fact that an extremely thin stratum of muscle next to the mucosa had not been severed, though the wound gaped widely at operation. The cat killed 14 weeks after operation showed a shallow diverticulum at the site of the division of the sphincter, with no covering layer of muscle; and that killed 18 weeks after operation showed a moderately wide scar with no hernial bulge of the wall of the sphincteric canal in this situation.

The Effect upon Function.—*Figs.* 173 to 178 were drawn with a reducing apparatus from skiagrams, and a comparison of the two series shows the effect of the operation upon the emptying time of the stomach. The interpretation to be put upon such series can be arrived at only after a very careful consideration of all the factors in the experiment. It is very difficult to reproduce, in all their details, the circumstances in being at

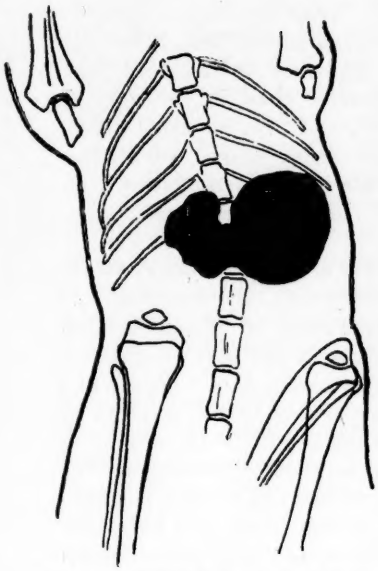

FIG. 173.—Fifteen minutes after meal: before operation.

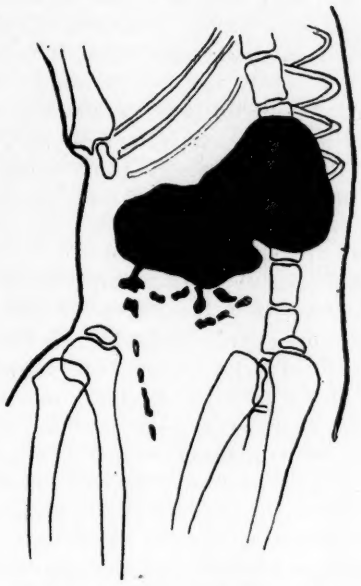

FIG. 174.—Forty minutes after meal: before operation.

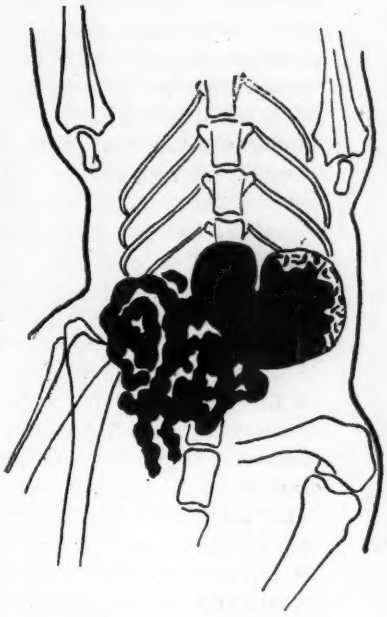

FIG. 175.—One hour and a quarter after meal: before operation.

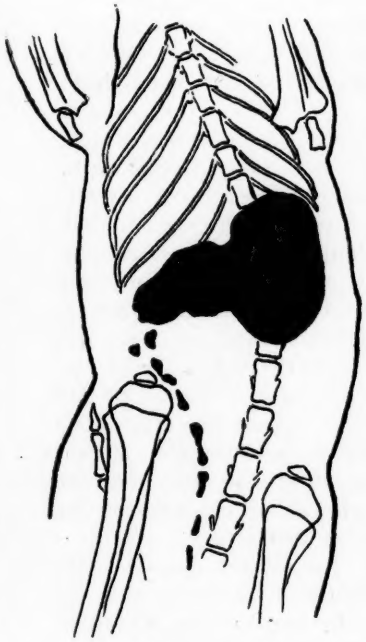

FIG. 176.—Ten minutes after meal: after operation.

FIG. 177.—One half hour after meal: after operation.

FIG. 178.—One hour and a quarter after meal: after operation.

one experiment, on a subsequent occasion. The powerful psychic influences which affect the motility and secretion of the stomach are especially difficult to control. The disturbing effects upon the animals of being taken from their usual feeding place into a dark room with many strange noises, and the restraint necessary to obtain a satisfactory photograph, must tend to vitiate the results; but after carefully weighing such considerations, and after examining several series of radiograms, it becomes apparent that, following a simple division of the pylorus, during the earlier stages of digestion food passes into the duodenum and jejunum more quickly and in greater quantity than in the normal animal. A comparison of *Figs.* 173, 174, and 175, with 176, 177, and 178, illustrates this. On the other hand, I cannot affirm confidently that during the later stages of gastric digestion this acceleration of the passage of food into the duodenum is maintained. In the animal in which the section healed with the formation of a linear scar no alteration in the rate of gastric expulsion was seen.

A Discussion on the Experimental Results and their Bearing upon the Possible Extension of the Operation to Certain Disorders of the Stomach.—In the light of these experimental findings, we may conclude, first, that the operation of simple division of the normal pyloric sphincter leads to a certain initial increase in the rate of passage of food through the stomach, and a probable earlier complete evacuation of this viscus: secondly, that these effects may be temporary or permanent according to the method of healing of the wound. Either tone and function will return to the muscle ring, as it does after a similar incision of the anal sphincter, a narrow linear scar alone remaining at the site of operation; or the partitionary power of the pyloric sphincter will be lost permanently, with perhaps the formation of a shallow diverticulum of the canal. I have not obtained evidence that a vicarious sphincter in the duodenum comes into action when the function of the pyloric sphincter is lost, as Cannon and Blake[1] assert.

Certain subsidiary questions immediately arise in connection with the functional results of such an operation, the answers to which have not as yet been sought experimentally: (1) Is the period of the complete secretory curve after the ingestion of a given meal reduced *pari passu* with the more rapid escape of the chyme from the stomach? (2) Does the earlier passage of stomach contents into the duodenum lead to a similar prompt response in the form of a hasty efflux of the pancreatic and hepatic secretions? (3) Does the operation allow of an increased backflow of duodenal contents into the pyloric antrum?

The answers to such questions would form the considerations which should determine whether or not the operation should be practised in some gastric disorders of man. In this connection it has already proved an unqualified success in the treatment of congenital hypertrophic stenosis of the pylorus, and, because of its success, there are but few opportunities to examine the late anatomical results. Functionally it is clear that the increased ease of evacuation of the stomach is permanent; but it is not so evident that this is due to the persistence of the primary abolition of function of the pyloric sphincter, for Downes[2] was able to examine two children who died from other causes, one, and one and one-half, year respectively after the operation, and he describes the sphincter of the stomach as being normal in appearance, a linear scar alone remaining as evidence of the operation. This observation has been confirmed by Ransohoff (discussion following Downes' paper). It has been suggested that relief is permanent because the hypertrophied sphincter does not increase in size and strength at an equal rate with the rest of the stomach musculature. It is this felicitous law of growth which enables an operation, which in itself gives temporary benefit, to be of lasting advantage.

It is possible that this sphincteric operation might improve the altered gastric function in three clinical conditions. They are the cicatricial contraction following ulcer at the pylorus, the spasm of the pylorus associated with ulcer of the body of the stomach, and hyperchlorhydria. Graham[3] has performed the operation for the first of these conditions, but after-results are still awaited. In the case of spasm due to an ulcer of the body of the stomach, relaxation of the sphincter might lead to earlier evacuation of gastric contents, and a lowering of gastric-juice acidity, due to regurgitation of duodenal contents.

Boldyreff[4] asserts that in hyperchlorhydria the normal reflux of duodenal contents through the pylorus into the stomach does not take place, and this suggests that in such cases a higher percentage of hydrochloric acid is necessary to provide the adequate stimulus to pyloric relaxation. The tone of the sphincter, and so the necessity for such high acidity, would be abolished by sphincteric division. The conditions suggested as forming a profitable field for exploitation of the procedure would call for a permanent diminution of sphincteric control, if any benefit accruing from it were to be lasting. The operation for such cases would have to be modified accordingly. To attain this end, one of two stratagems would probably be effective, judging by analogy of what happens in operations upon the anal sphincter: the interposition of a wedge of omentum between the two extremities of the cut muscle band, or an oblique division of the sphincter.

One other question must be touched upon. Is any harm likely to come from a diverticulum should one form at the site of operation? The answer to this question can only be given after a sufficient trial; but it would seem to be this, that however fraught with danger diverticula may be in the colon or other regions of the alimentary canal, such abnormalities have been recognized for years as occurring occasionally in the duodenum, but their presence has never been correlated with recognizable symptoms.

My thanks are due to Sir Almroth Wright and the departmental directors of the Pathological Institute of St. Mary's Hospital, by whose courtesy I have been afforded facilities for carrying out this investigation; also to Sister C. M. Harrison, of the *X*-ray Department at St. Mary's, for her skill and patience in taking radiograms of the animals.

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[2] Downes, *Jour. Amer. Med. Assoc.*, 1920, July 24.
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OPERATIVE PROCEDURE SUGGESTED FOR THE REPAIR OF COLLATERAL LIGAMENTS OF THE KNEE-JOINT.

By ALEXANDER H. EDWARDS, Glasgow.

Whilst acting as surgeon to the 3rd Scottish General Hospital, two instances of severe injury to the knee-joint came under my care. In each there was extreme lateral movement of the tibia on the femur in both directions whilst the knee remained extended.

In the first case shrapnel was the cause, the wound of entry being situated medially near the line of the joint, while that of exit was laterally placed, extending irregularly above and below the articular margin of the tibia.

The wounds had healed comparatively rapidly as a result of careful primary treatment in France. Radiography disclosed no alteration in bony structures, but showed an irregular piece of shrapnel close to the anterior margin of the medial tibial articular facet. The metal had been localized and removed through an incision somewhat similar to that adopted for the excision of loose cartilage.

On admission, lateral mobility in extension was well marked, and, in addition, it was possible passively to displace the tibia backwards in full flexion of the leg on the thigh, suggesting that the posterior cruciate ligament was ruptured. In the extended position there was no sign of injury to the anterior cruciate ligament. The quadriceps was slightly atrophied from diminished function, but the patella and its ligament of insertion were normal, as also were the muscular and musculotendinous structures in the immediate vicinity of the joint. Hyperextension at the knee was present, though slight in degree; but this was the more significant as the patient had not attempted to bear any weight subsequent to his accident.

The second case was that of a soldier who had fallen into a shell-hole after having been severely wounded in the knee.

On admission to the home hospital his wounds had healed, but there had been some degree of sepsis in the joint. There was difficulty in walking, owing to side-to-side insecurity and to weakness of the quadriceps extensor, which was atrophied considerably. The unnatural mobility and instability of the joint on both sides were outstanding features, but in this instance no evidence of injury to either of the cruciate ligaments was found.

It was obvious that in both these cases the pronounced instability of the joint could only be eliminated by mechanical support or possibly by operative treatment. The musculotendinous structures around the joint were intact; the capsular ligament in both was loosened or stretched posteriorly. It was thought that the best treatment might lie in the direction of operative repair of the collateral ligaments, with perhaps ultimate repair of the injured cruciate ligament in the first case. As some months had elapsed since the reception of the wound, the consideration of repair of the cruciate ligament was delayed, the treatment of the collateral ligaments seeming to be much more important. With this object in view, examination on dead subjects showed that the tendon of the biceps cruris might supply a useful flap, and that this could be reinforced by a flap of the fascia lata; that on the medial aspect the tendons of the semitendinosus and gracilis could be dislocated dorsally and united after separation from their muscle bellies, and that in both instances these could be fixed in suitable grooves of bone simulating the normal structures fairly closely. Recognizing the fact that ligaments play a passive rôle, the desideratum was to produce in each case as nearly as possible the anatomical line of the normal ligament and to construct and insert it securely under normal tension.

The operation was therefore carried out with the knee-joint in the slightest degree of flexion.

Some time ago, Mr. McMurray, of Liverpool, devised an operation for repair of the medial ligament. In this he utilized the sartorius muscle, which seems very conveniently placed for the construction of a new ligament. Still, with all diffidence and respect, it is suggested that it may not be desirable to have the proximal limit of the ligament continuous with an active muscle. Also it seems to the writer that the tendons of the gracilis and semitendinosus make a typical ligament, either singly or together. In the operations described below, both tendons were utilized, so as to eliminate all possibility of weakness; but my friend Professor Waterston, of St. Andrews, is of opinion that one only of these tendons would be sufficiently strong for the purpose. Several months after operation the result as regards lateral stabilization of the knee was quite satisfactory. A moderate degree of stiffness and slight limitation of flexion had been present, due to the original injury and partly to splintage; but these disabilities were never extreme and had considerably improved.

In the first case the use of a posterior knee-cage as recommended by Sir Robert Jones was of great value. The writer has not dealt with a simple case of laceration and destruction of either of these ligaments occurring in civilian practice, but thinks that, in most of these, the operations described below would be more easily applied with satisfactory results than in complicated war injuries.

In cases of extensive injury to the knee-joint, i.e., wherein the collateral and cruciate ligaments have been permanently damaged, the collateral ligaments must, if possible, be repaired first. The cruciate ligaments may be considered later, as the action of these in lateral—i.e., external—rotation of the tibia shows. This movement is in the direction of relaxing these ligaments, or in other words undoes their torsion, so that during this process their only function is that of preventing the separation of the femur from the tibia. But the practical point to note is that, during this phase, both collateral ligaments are normally very tense, thereby maintaining side-to-side stability and apposition of adjacent bones, with prevention of further rotation.

Medial rotation of the tibia on the femur, as is well known, is limited by the torsion of the cruciate ligaments, and at its limit by tensity of the collateral ligaments; so that both rotations of the tibia are controlled by the collateral ligaments, whereas lateral or external rotation is not opposed by the cruciate ligaments; this supports the view suggested, that the collaterals are the more important group in maintaining the stability of the knee.

REPAIR OF THE LATERAL LIGAMENTS OF THE KNEE: THE OPERATIVE TECHNIQUE.

FIBULAR COLLATERAL LIGAMENT (EXTERNAL LATERAL LIGAMENT).

1. Incision to expose the fascia lata, lateral condyle, tendon of the biceps cruris, and the head of the fibula.

2. Make a rectangular flap about 3 in. long from the fascia lata, with its base at the femoral condyle. Fold this flap to make a strong narrow band, and apply some stitches to maintain the folding (*Fig.* 179).

3. Raise a longitudinal vertical flap from the tendon of the biceps, incising the tendon at about the level of the joint: this should be about 3 in. also.

4. Separate the fibrous connective tissue over the lateral condyle, where the ligament is normally attached: draw the margins aside, expose the bone, and gouge out a small cavity about $\frac{1}{4}$ in. deep by $\frac{1}{2}$ in. long, in the vertical axis of the limb.

5. Operate on the head of the fibula in an exactly similar manner, scooping out a groove as before. Now pull forward the biceps flap and insert it into the groove made in the lateral condyle, fix it there with a small staple, and stitch the connective-tissue edges over it (*Figs.* 180, 181).

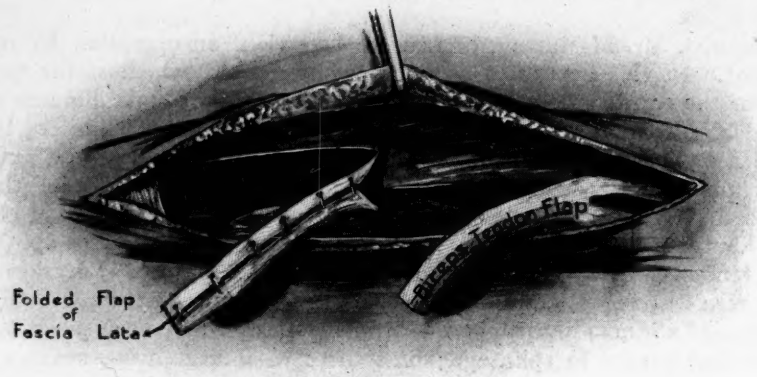

FIG. 179.—The oblong flap formed from the fascia lata has been folded on itself and the edges sutured together, so that it becomes approximately one-third its former breadth and about twice its former strength. The distal flap is raised from the strong fibro-aponeurotic tissue which extends from the biceps tendon of insertion proximally for a considerable distance, on the deep surface of the muscle-tissue proper. The fibroperiosteum on surface of head of fibula has been separated and a depression formed in the osseous tissue of this bone.

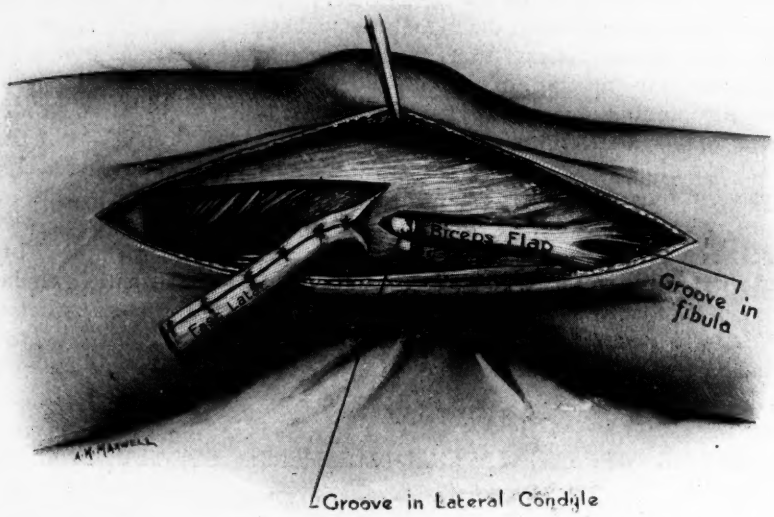

FIG. 180.—Another grooved depression has been formed in the lateral condyle, exactly where the normal ligament was attached. The biceps fibro-aponeurotic flap has been fixed in this, at full tension, by means of a staple.

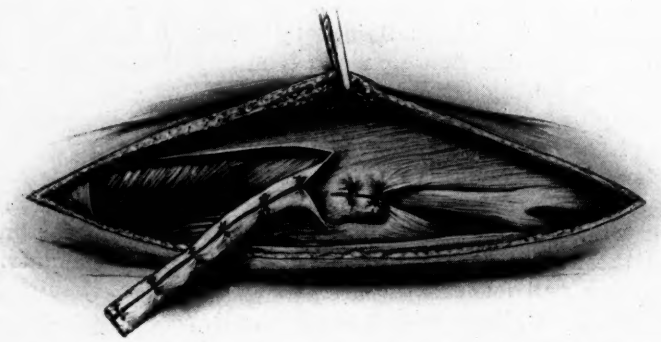

FIG. 181.—The gap over the artificial insertion has been covered by deep fascia; and the proximal or fascia lata flap is ready for insertion into the groove in head of fibula.

6. Turn down the flap from the fascia lata; insert it into the head of the fibula as above with a staple, etc., maintaining in both instances strong tension whilst fixing (*Fig.* 182).

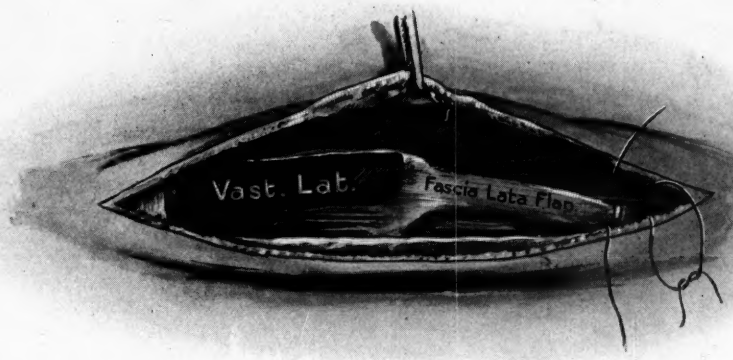

FIG. 182.—The proximal flap has been turned distally, and fixed into the head of the fibula by a staple. Suturing of the deep fascia over the newly-placed ligaments has been begun distally.

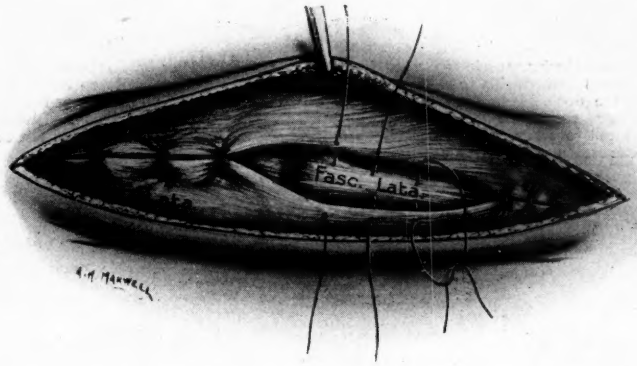

FIG. 183.—The gap in the fascia lata is here closed, as also is the gap opposite the superficial of the two flaps. In the latter the sutures are piercing the flap transversely.

7. Apply a few stitches through both flaps, and then stitch the gap in the fascia lata (*Fig.* 183).

8. Suture over all the deep fascia.

9. Lastly, suture the skin.

TIBIAL COLLATERAL LIGAMENT (INTERNAL LATERAL).

1. Incise along the medial aspect of the knee with the centre approximately at the medial condyle (normal attachment of the tibial collateral ligament); continue the incision proximally and distally, exposing the sartorius from the lower end of its fleshy belly to the tendon close to its insertion (*Fig.* 184).

2. Separate the sartorius from the condyle, and expose the gracilis and semitendinosus tendons: by blunt dissection these latter can be separated and pulled forwards.

3. Divide both these tendons at the level of the medial condyle (gracilis and semitendinosus), dissect them from their attachments, and pull them well forwards—caught up in pressure forceps, which have also to be applied to the proximal parts.

4. Make a groove in the medial condyle similar to that in the previous operation, and situate over the point of attachment of the ligament.

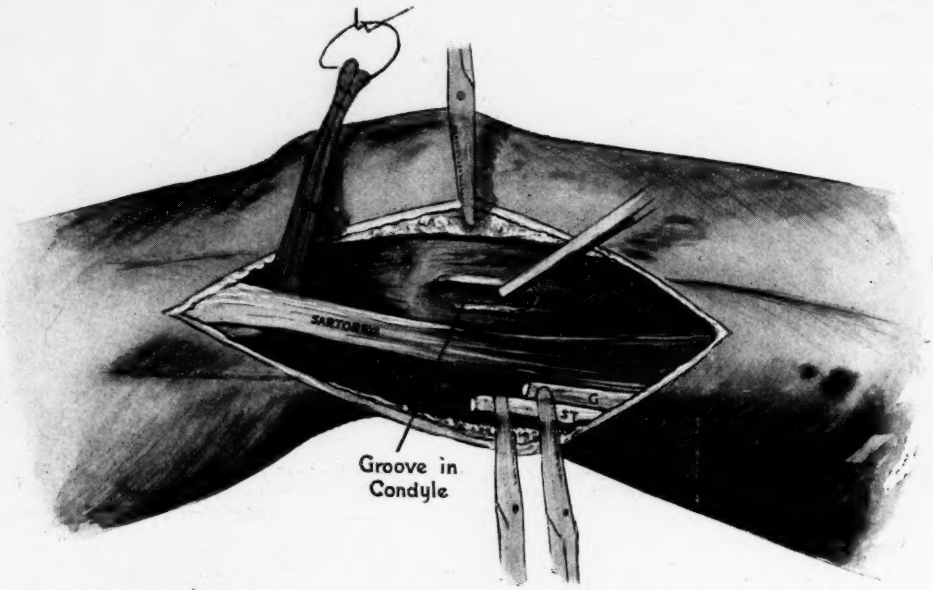

FIG. 184.—Shows the sartorius muscle separated from the deep fascia, after having been pulled ventrally to some extent; the semitendinosus and gracilis tendons are found on the deep surface and ventral to the sartorius. It is important to preserve the deep fascia, especially that ventral to the sartorius. The former is not well defined in the drawing. To prevent retraction the two tendons are clamped proximally before division. Distally the tendons are pulled dorsally and sutured together. The fibroperiosteum has been split longitudinally over the medial condyle, and a grooved depression excavated in the bone underlying it.

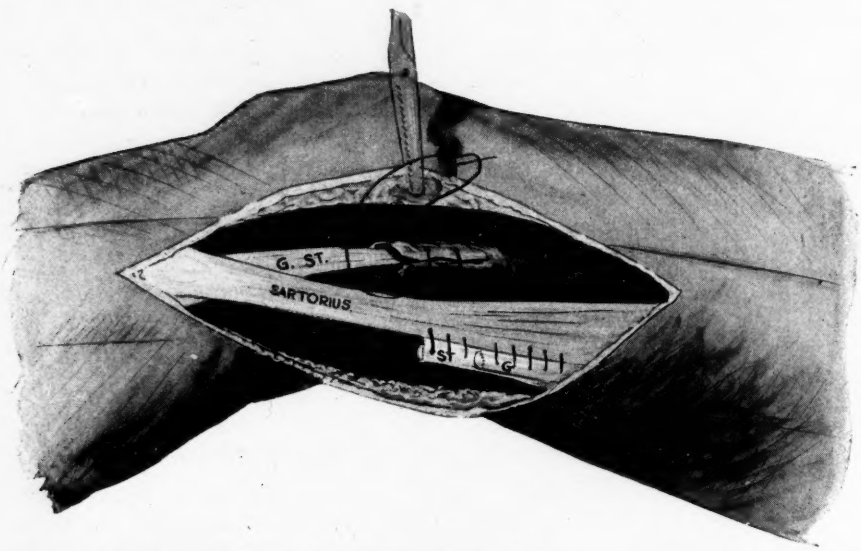

FIG. 185.—The united tendons at full tension are here inserted into the groove and fixed by a staple. The fibroperiosteum is in process of suture over and through the tendons. The proximal sections of the two muscles are distally sutured to the sartorius under moderate traction.

5. Stitch the distal parts of the tendons together, firmly and overlapping; or rather, parallel.

6. After seeing that these are well separated to their insertion on the tibia, and after

pulling them well forwards, it will be found that they are in the long or vertical axis of the limb.

7. Place the proximal end of this distal portion in the groove prepared, and stitch over it the fibrous tissue of the condyle, after having fixed it in the groove with a staple.

8. Suture proximally the gracilis and semitendinosus to the sartorius so that the active contractile function of these muscles is not lost (*Fig.* 185).

9. Suture the deep fascia to the sartorius, which must be pulled well backwards so that the normal line of traction of this muscle (and through it of the gracilis and semitendinosus) is properly maintained (*Fig.* 186).

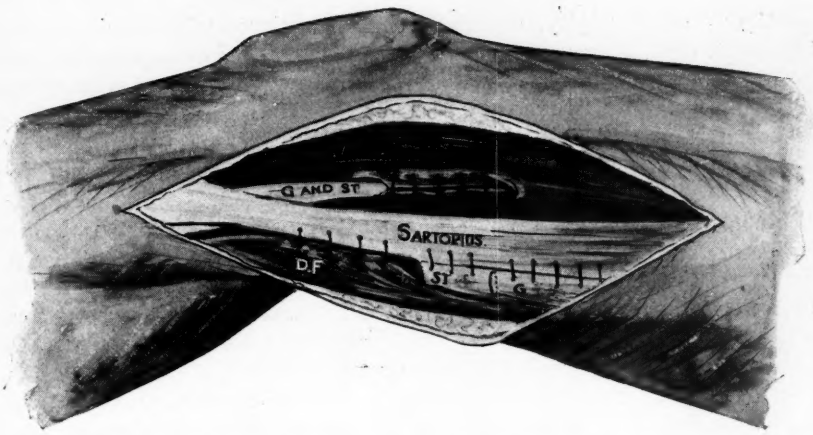

FIG. 186.—The sartorius muscle is pulled as much as possible ventrally, and fixed down with sutures through the deep fascia (D F). More proximally the three muscles united should be drawn also ventrally, and sutured so as to maintain the sartorius, etc., in their normal sites.

10. Close up the subcutaneous areas and skin.

11. It is best to apply a light plaster-of-Paris splint to the limb, extending from the mid-thigh to mid-calf, and let it remain immobilized for about fourteen days.

12. Later, massage must be applied, and in about one month gentle active movements.

Grateful thanks are herewith tendered to Professor Bryce for his kindness in granting the use of the Anatomy Department at the University of Glasgow; to Professor Waterston, St. Andrews University, for a like privilege; also to Professor Walmsley, Queen's College, Belfast, for kind help.

THE TREATMENT OF STIFF METACARPOPHALANGEAL JOINTS WHERE THERE IS NO GROSS BONY ALTERATION.

By JAMES A. DICKSON, Birmingham.

Injuries of the upper extremity, especially those associated with sepsis and nerve lesions, are often followed by stiffness of the metacarpophalangeal joints, usually in the extended position. This condition has been particularly common in cases of war injuries, but also tends to occur as a result of severe industrial accidents.

The fact that this type of disability forms a large percentage of the cases admitted to the pensioners' orthopædic hospitals and clinics points to an incomplete knowledge of its prevention and treatment. It has been suggested that splintage has been mainly responsible for this disability, but the fact that it is a common sequela to nerve injuries and sepsis, even where massage and movement have been carried out from the initial stages, goes to prove that these are independent factors in the production of this condition.

Without flexion of the metacarpophalangeal joints there is a very serious loss of function of the hand, as a good grasp is impossible. Clinically the condition is very characteristic; the metacarpophalangeal joints are held in the extended or hyperextended position, and no voluntary flexion is possible. Any attempt at voluntary movement results only in flexion of the distal phalanges. The condition would appear to be due to: (1) Fibrosis of the joint capsule; (2) Contracture of the extensor tendons or involvement of these tendons in scar; (3) A combination of the above.

A very simple clinical test to differentiate between tendon shortening and fibrosis of the joint is as follows: Pressure is applied on the head of the first phalanx until the metacarpophalangeal joint is flexed as far as possible. If flexion of the interphalangeal joint is then possible, the limitation of movement is due to a capsule condition. On the other hand, if the interphalangeal joints cannot be passively flexed except when extension of the metacarpophalangeal joints takes place, then the condition is one of tendon involvement or shortening. It is interesting clinically to know which is the predominant factor, but it is immaterial as far as the treatment is concerned, as this is identical whether the loss of movement in these joints is due to fibrosis of the capsule or shortened tendons.

The treatment of these stiff joints has, as a rule, been a lengthy procedure, and in many cases has been exceedingly disappointing, not only for the patient but also for the surgeon. We are constantly having referred to Highbury and Uffculme Hospitals cases which have received treatment for months and even years, and were finally discharged to make the best of their disability, although there were in these cases potentialities of a complete recovery. Many attempts have been made to overcome this persistent disability and to shorten the usual prolonged period of treatment. Among the methods advocated are: (1) Gradual flexion while traction is applied to the fingers—banjo method; (2) Division of the joint capsule with fixation of fingers in flexion; (3) Mobilization under an anæsthetic with fixation of the fingers in flexion; (4) Gradual correction by means of plaster.

All these methods have a varying degree of success, but the best results at Highbury and Uffculme Orthopædic Hospitals have been obtained by gradual flexion with plaster. In all methods there is a tendency to relapse when the splintage is removed for purposes of massage, etc.: this has now been overcome by the use of a special 'retaining bar' which is applied between treatments.

The following plan, which has been adopted at the above hospital for the treatment of this type of case, appears to be very effective. The results to date are most gratifying,

and there is no doubt that the usual prolonged treatment can be greatly reduced. What is more important still, relapses are practically nil. The principle of the treatment is that the metacarpophalangeal joints are gradually flexed with plaster; then, by means of the 'retaining splint', this flexion is maintained between the massage treatments until there is full voluntary flexion and no tendency to relapse. The ability to flex the joints voluntarily and retain the flexion is the indication for the removal of the splint. If, with freedom, there is any tendency towards limitation of the flexion obtained, the splint must be re-applied for a further period.

The following illustrations show the method of flexing the joints:—

Fig. 187 shows the plaster case applied to the arm, and the chief features are: (1) The case must be suitably padded, but not too much; otherwise it becomes loose. (2) A short plaster slab is used for the dorsum of the hand and fingers, and another to form a cock-up for the wrist, the plaster being moulded to flex the fingers as much as possible (*Fig.* 187, A). (3) The plaster must incorporate the elbow (*Fig.* 187, C) in order to prevent slipping and thus minimize any tendency of the plaster to cut into the hand during the wedging procedure. This is very important.

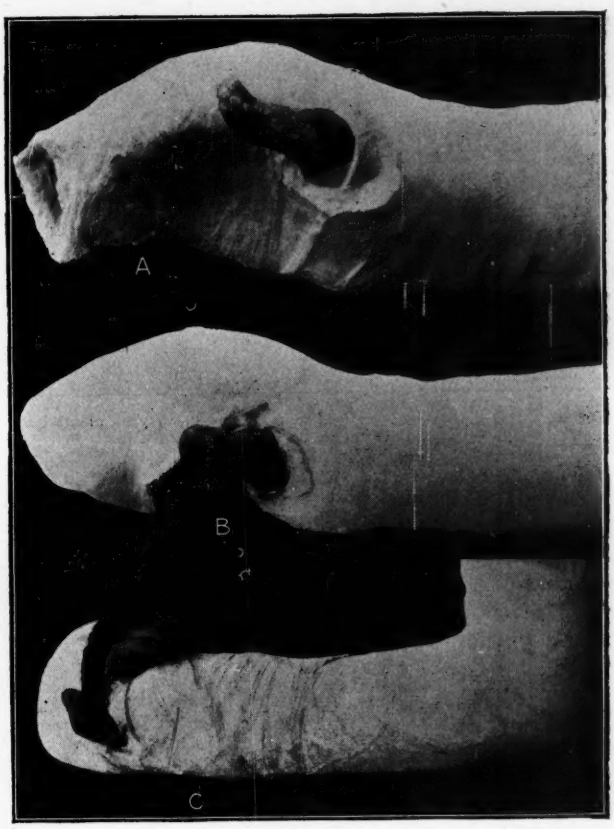

FIG. 187.—A, Plaster case applied; B, Case with the anterior portion cut away to allow flexion of fingers; C, Fingers in full flexion.

When the plaster is properly set, and preferably has had a day to dry, the anterior portion is cut away, leaving a plaster cock-up about half-way up the palm (*Fig.* 187, B). Felt pads are then wedged between the posterior slab and heads of the first phalanges. As the metacarpal bone is fixed (in the plaster case), the maximum result of any force to flex the metacarpophalangeal joints, and thus stretch the contracted structures, would be a force acting on the heads of the first phalanx at right-angles to the shaft, an important mechanical advantage which is obtained by this method. A force so applied results in flexion of the joint without any tendency towards impaction of the joint surfaces. The pads are fixed in place by means of a plaster bandage in order to prevent removal. It is seen that the finger-tips are quite free, and the patient is instructed to keep pulling at them to increase the flexion. In two to three days the fingers will be found to be quite loose again. Another felt pad is then added behind the first phalanx, and thus the wedging is carried on until the metacarpophalangeal joints are fully flexed. *Fig.* 187, C, shows the end-result: metacarpophalangeal joints fully flexed. The average time needed to bring a fairly stiff case into full flexion is about four weeks.

The above method of flexing the joints has been found to be most effective, chiefly because a constant pressure could be obtained which could not be interfered with. In ischæmic conditions and those of long standing, it is difficult to obtain the initial flexion

of the joints; but I have not had a case of the type under consideration where it has been impossible to obtain full flexion. When the maximum flexion is reached, the joints are usually left in this position from a week to ten days, in order that any local reaction may subside, and to make sure that the structures are thoroughly stretched. Although the joints have been fully flexed and kept so for some time, and although the joints appear to be quite free, yet if the plaster were removed and the fingers left, within a few hours they would probably tend to relapse into the old position. It is therefore most important that the flexion we have gained is retained, and the method by which this is done is as follows:

FIG. 188, A and B.—Padded bar and metal spring in position, maintaining the flexion of metacarpophalangeal joints.

As shown in *Fig.* 188, the plaster cap and felt pads are now removed, exposing the dorsum of the wrist and hand, but otherwise the plaster case is left intact. A piece of metal with a V cut in the top to act as guide for the wire, is incorporated in the plaster opposite the wrist-joint (*Fig.* 188, A and B), and also another piece of metal with a ring is fixed near the elbow. A leather-covered and padded metal bar is then placed over the heads of the proximal phalanges, and from the centre of this a wire runs between the middle and ring finger over the guide to a metal spring, which is fastened to the ring by means of a tape as shown in the figure. By adjusting the spring, sufficient force can be applied to keep the fingers flexed. Owing to the position of the fingers and the direction of the force, there is no tendency whatever

FIG. 189.—Splint with flexion-bar removed, to allow of massage and movement.

for the bar to slip off the ends of the fingers. Attention is drawn to the fact that the bar rides on the heads of the proximal phalanges, and the pull is approximately at right-angles to the shaft of the bone, which, as pointed out above, is most efficient mechanically.

In *Fig.* 189 the flexion-retaining bar has been removed so that massage and movements may be undertaken. The bar is re-applied after treatment.

FIG. 190.—The plaster case has been replaced by a short cock-up and the spring leather elbow-case, allowing of elbow movements.

After about ten days' treatment, the plaster case is removed and replaced by a short plaster cock-up and a laced leather elbow-case, as in *Fig.* 190. The elbow-case fixes a strap just above the condyles of the humerus to which the spring is fastened. Movements of the elbow are not then restricted on account of the position of the strap. If the spring is tightened when the elbow is flexed, there is only a very slight increase in the tension when the elbow is extended. [It might be mentioned at this stage, that the fixation of the elbow for four to seven weeks in the initial stages has not as yet resulted in any limitation of its movement.] By means of this splint, the metacarpophalangeal joints are kept in full flexion until the normal function of the joints is established. At the same time the patient has full advantage of the various baths, massage, etc. In the final stage, in order to obtain the flexion of the interphalangeal joints, tapes may be used instead of the bar, as shown in *Fig.* 191, A; but they must not be employed before flexion of the metacarpophalangeal joint is assured, because, if the proximal phalanx is in an extended position, the greater percentage of the force applied causes only an impaction, and not any real flexion of the metacarpophalangeal joint (*Fig.* 191, B). As was pointed out previously, the ability to retain the flexion voluntarily is the indication for the removal of the splint, and any tendency to relapse is an indication for further splintage.

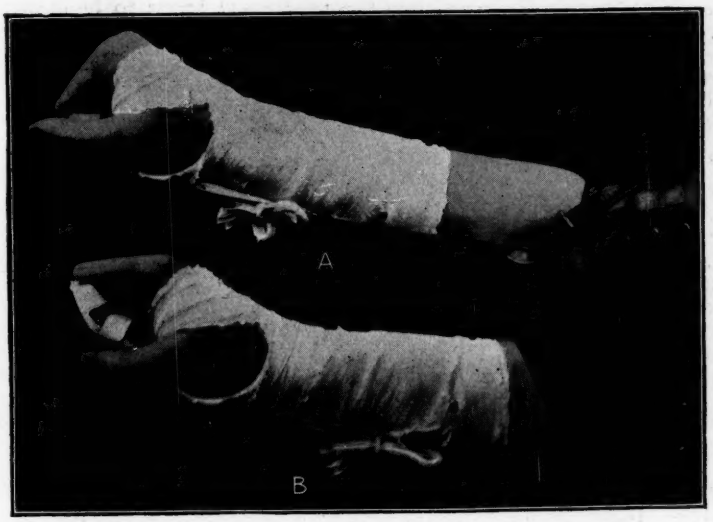

FIG. 191.—Final stage: flexion retained by use of tapes. A, The correct position; B, Faulty and useless position for applying tapes.

The following are a few of the points in favour of this method of treatment of the disability in question: (1) Flexion of the metacarpophalangeal joints can be maintained, and at the same time the patient may have the benefits of baths, massage, etc.; (2) The mechanics of the procedure are correct; (3) The apparatus and its application are exceedingly simple; (4) No anæsthetic is required; (5) The time under treatment is greatly diminished and the number of relapses minimized.

The following three cases which have been treated on the above lines are typical examples of the worst kind, and show the initial and final conditions.

FIG. 192.—*Case* 1. J. F. A, Before, B, After treatment.

Case 1.—J. F.—Late Pte.—Admitted to this hospital Oct. 12, 1919. He had sustained a severe gunshot wound of the left wrist in March, 1916. Wounds were healed by June, 1918. He had been having massage treatment for eighteen months before admission. There was much damage to the lower end of the radius and the carpal and metacarpal bones, with resulting ankylosis in the straight position. The inferior radio-ulnar joint was not involved, and *x* rays showed the metacarpophalangeal and the phalangeal joints to be clear. The extensor tendons were involved in the scar.

Fig. 192, A, shows the maximum possibility of closing his hand, either passively or voluntarily, on admission. *Fig.* 192, B, shows his condition on March 1, 1920. Full voluntary flexion and extension were possible.

Case 2.—A. E. J., late Pte.—Wounded January, 1917. Gunshot wound of left forearm. There was no injury to main structures. Wound healed five months after injury. Was admitted to hospital Sept. 14, 1919.

Fig. 193, A, shows the condition, and the maximum degree of flexion possible at that time. In this case the chief difficulty was tendon shortening, but the capsules were also involved. *Fig.* 193, B, indicates the end-result, March, 1920, showing normal range of movement.

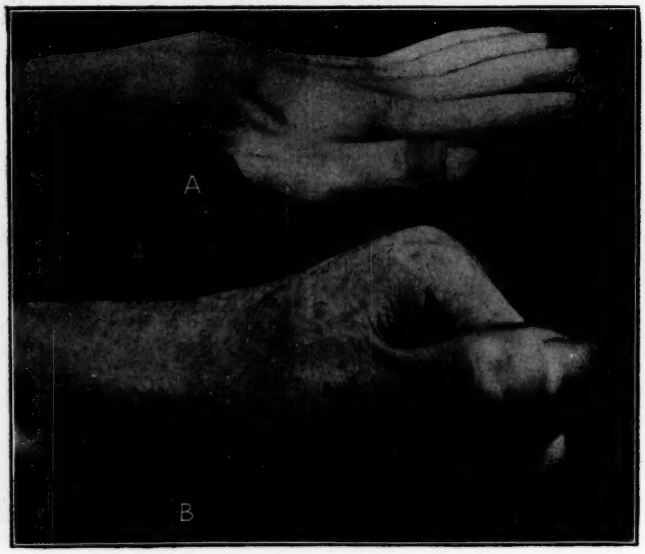

FIG. 193.—*Case* 2. A. E. J. A, Before, B, After treatment.

Case 3.—F. E. W., late Pte.—Wounded July, 1916, in right shoulder. Subclavian aneurysm developed a few weeks later, and was tied off. Had treatment up to the time he was discharged about the middle of 1918. He reported at Highbury on

Feb. 4, 1919, with a condition as shown in *Fig.* 194, A. There was a severe ischæmic condition, the hand was distinctly 'griffe', and the metacarpophalangeal joints were hyperextended. There was a fibrosis of the wrist-joint and all the joints of the hand, and practically no movement was possible. Four months were spent with treatment by hot baths and massage, in order to improve the general condition of the circulation in the hand. His wrist was then forcibly moved in plaster, and normal movement obtained. [I should like to point out in this connection that, if both the wrist and metacarpophalangeal joints are involved, it will be found more advantageous to correct the wrist first and, if possible, have it in a position of dorsiflexion before anything is done for the metacarpophalangeal joints.]

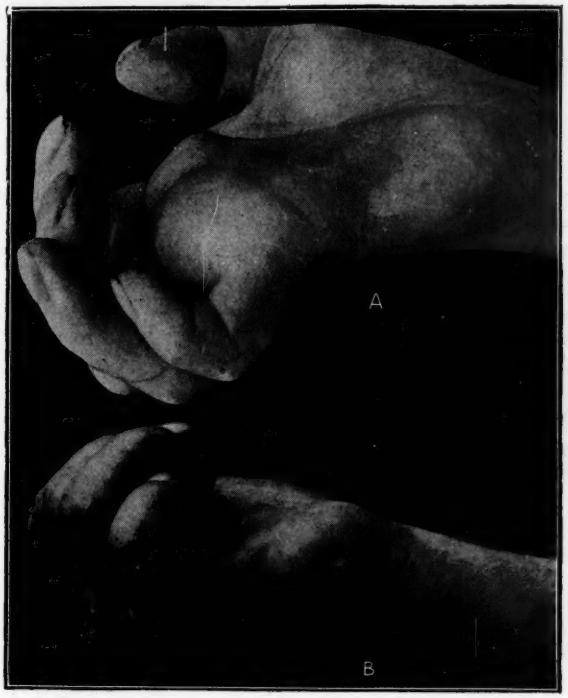

FIG. 194.—F. E. W. A, Before, B. After treatment.

On Oct. 12 the plaster case was applied for flexion of his metacarpophalangeal joints, and *Fig.* 194, B shows his condition on March 1, 1920. Full voluntary range of movement was then possible.

The above three cases, which are no doubt examples of the worst of their type, have only averaged from six to seven months before full range of movement was obtained in the metacarpophalangeal joints, and I consider these results speak well for the efficiency of this method of treatment.

REGIONAL ANÆSTHESIA, WITH SPECIAL REFERENCE TO 'SPLANCHNIC ANALGESIA': A NEW METHOD APPLICABLE TO ABDOMINAL SURGERY.

By Dr. GASTON LABAT.

Every abdominal operation consists of two steps: (1) *Laparotomy* (incising the abdominal wall); (2) *Dealing with the diseased viscus.*

1. **Laparotomy.**—This has been performed under local anæsthesia since the days of Reclus and Schleich. These pioneers made use of infiltration of the line of incision. Sellheim, in 1905, attempted to anæsthetize the anterior abdominal wall by injecting the nerve-roots close to the spine, from the eighth dorsal to the first lumbar; but, according to Braun, the results were not very encouraging. In 1911, Laewen, making use of a method of his own, devised from Sellheim's experiments, published a series of successful cases, and called the method *paravertebral conduction anæsthesia.* From that time onwards many authors, among whom are Finsterer, Braun, Kappis, Allen, Harris, Fischer, Kroenig, Siegel, Kimpton, Victor Pauchet, Sourdat, Labouré, and ourselves, employed this method with varying success; but finding it tedious to the anæsthetist and trying to the patient, a certain number of experiments were conducted with a view to finding a simpler method.

2. **Dealing with the Diseased Viscus** by local anæsthesia has now been proved to be possible only when the deep injections are made along the line of the sympathetic chain, where the rami communicantes join the sympathetic nerves. In 1917, Wendling (of Bâle), in his thesis, reported twenty-seven cases in which anæsthesia for various gastric operations had been obtained by injecting 50 to 80 c.c. of a 1 per cent novocain solution through the anterior abdominal wall into the solar plexus or its vicinity. The abdominal wall having been rendered insensitive by a local injection, the needle was inserted through it, piercing the left lobe of the liver and the gastrohepatic omentum, and reaching the neighbourhood of the solar plexus.[1] Allen and Victor Pauchet had obtained the same result by the much safer and simpler process of injecting a smaller quantity of novocain-adrenalin directly into the solar plexus after opening the abdomen.[2]

But these procedures are sometimes very difficult. In stout individuals with tense rigid abdominal walls, as soon as the abdomen is opened, the contents bulge out, and even the packing back is not always a very easy task. In thin relaxed patients it is usually possible, when much gentleness is used, to slip in two fingers, thus opening the way for the needle to the solar plexus or the retroperitoneal tissue in its vicinity, care being exercised in the neighbourhood of the large vessels. Even under the best conditions, the technique is only possible in the hands of those who have acquired sufficient experience of the local methods within the abdominal cavity.

Taking up the subject, we were prompted to seek to improve upon this technique for two other reasons: (*a*) It is much more convenient both for the patient and the surgeon that the anæsthesia be completed before the operation is commenced; (*b*) Because the results so far obtained were by no means constant.

In the meanwhile, Naegeli and Kappis, experimenting independently of each other, endeavoured to find a route to the splanchnic nerves through the posterior abdominal wall. Naegeli, in 1919, published eighteen cases, most of which were successfully anæsthetized by his method.[3] We had already been led to select a posterior route as the best means of anæsthetizing the upper part of the abdominal cavity, not because we believed

that the solar plexus or the splanchnic nerves were the sole or the chief paths of conduction of painful impulses, but because, in our opinion, pain in gastric operations is chiefly due to traction on the parietal peritoneum, resulting in the cleavage of the retroperitoneal tissue, which is richly supplied by cerebrospinal nerves.

Adopting the site of injection advised by Naegeli, we have devised a technique by means of which a complete anæsthesia of this tissue is obtained, and thus all operations on the upper part of the abdominal cavity can be painlessly performed. It is with a description of this method that we are chiefly concerned in this paper.

PRINCIPLES.

The Method.—Most of the patients sent to the surgeon for operation on the abdominal organs (stomach, liver or gall-bladder, and intestines) are in such a state of lowered resistance that it is often a question whether it would be justifiable to incur the risks of a general anæsthesia. These patients are auto-intoxicated to such an extent that the normal metabolism and the oxygenation of the blood are considerably altered, thereby interfering with the essential requisites of any general anæsthesia. In such cases the advantages of regional anæsthesia are obvious, inasmuch as its main effects are limited to a relatively small region of the body, leaving intact the central nervous system, upon the integrity of which depends the continuance of all the vital functions.

The Patient.—The degree of pain is not proportional to the intensity of the trauma. Individual differences are well marked. They depend upon many factors, among which the emotional play the chief part. Nervous excitement, specially due to apprehension, may be so great in some patients as to interfere even with the necessary manipulations of the local method. By these patients a slight touch is often interpreted as pain. It is therefore advisable, as a general rule, to blunt their consciousness, and for this purpose scopolamine and morphine have proved to be the best. We inject a solution containing scopolamine $\frac{1}{4}$ mgrm. and morphine 1 cgrm. one hour before commencing the anæsthesia. The injection of a smaller dose, or of the same dose at a later stage, acts on some patients rather as an excitant than a sedative. The patient should, immediately after the injection, be kept quiet in a darkened room. From this time onwards he should be handled as gently as possible, and every unnecessary stimulation carefully avoided.

The Anæsthetic.—Cocaine was the substance first used for local anæsthesia by Reclus and Schleich; but even these observers rejected it later on in favour of novocain. The analgesia produced by novocain is delayed, and of relatively short duration. It is therefore necessary to add some adrenalin to it, which accelerates its effects and renders it as active as cocaine.

For the purposes of regional anæsthesia it is necessary to inject a large quantity of fluid. With a view to reducing this quantity, a small proportion of cocaine was added to the novocain, expecting thus to obtain a reinforcement of the latter. A solution containing 0·1 grm. of cocaine and 0·9 grm. of novocain per 100 c.c., in doses of from 100 to 125 c.c., produced symptoms of intoxication (nervous excitement, cardiac distress, laboured breathing, pallor of the face, collapse; while in some cases the effects were limited to talkativeness, shouting, and singing). The reduction in the amount of liquid injected was negligible; but the duration of the anæsthesia was increased. A solution containing only cocaine (0·5 per cent) gave rise to even graver symptoms when about 40 c.c. had been injected. On the other hand, 100 to 125 c.c. of a 1 per cent pure novocain and adrenalin (25 drops per 100 c.c.) solution, injected systematically in a series of over 1000 cases, never produced any untoward effects, and the duration of the anæsthesia proved sufficient even for the longest operations.

We have thus been led to infer that *pure novocain-adrenalin solutions are the safest*, that *novocain-cocaine mixtures are dangerous*, and that *pure cocaine solutions should never be used in regional anæsthesia.*

The Anæsthetist.—Gentleness is the first requisite of the anæsthetist. Before anæsthesia is begun, the patient should be warned that he will feel but a few light pin-pricks;

but that all the subsequent operative manœuvres will be painless, although the sensation of touch will not be abolished. If he wishes to be unconscious of what is going on, his ears should be stopped and his eyes bandaged.

The anæsthetist should handle his needle and his patient with equal dexterity. His anatomical knowledge should be perfect, especially so far as nerve distribution is concerned. He should know how best to gain access to the nerve he wishes to anæsthetize. It is unnecessary to lay stress on the importance of asepsis. Needles and other instruments should be tested before use, to make sure of their efficiency. Anæsthetic wheals should be made wherever the skin is to be punctured. Bones serving as deep landmarks should be approached lightly with the needle, since the periosteum is very sensitive. The needle should never be previously fitted on to the syringe when it has to be introduced in the vicinity of large vessels. Before infiltrating, it is advisable to aspirate, in order to ascertain that the point of the needle is not lying in the lumen of a blood-vessel. If this is the case, draw the needle back a few millimetres and change its direction before proceeding any further. A small hæmatoma caused by the accidental wounding of a blood-vessel is of no importance. The injection should be made slowly, and the aspiration test renewed at intervals.

The Surgeon and his Assistants.—The surgeon should wait at least ten minutes to obtain the full anæsthetic effect. He should inspire his patient with confidence, make sure that the latter is lying at ease on a soft cushion, with as little restraint as possible, so that he will be able to undergo the operation with the minimum of discomfort. The patient should not be told when the operation begins. Sharp instruments should be used: cutting with the scalpel should be preferred to snipping with the scissors. On no account should the tissues be torn through or bruised by rough handling. Retractors should be introduced lightly and opened out gradually. Pulls on the viscera should be light and gradual. The organs should not be unnecessarily drawn out of the abdominal wound.

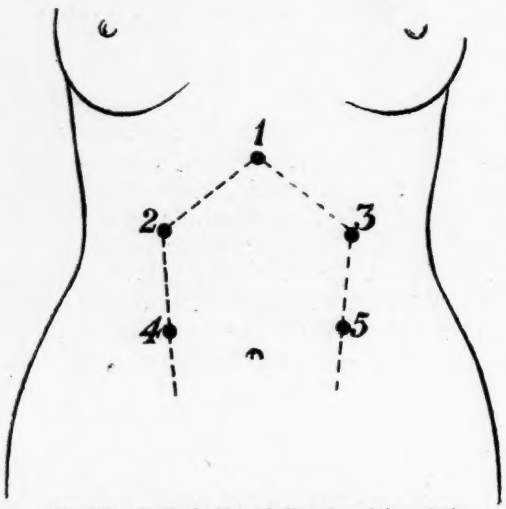

FIG. 195.—Method of local infiltration of the anterior abdominal wall. Through each anæsthetic wheal (1 to 5) the needle is inserted and pushed within the rectus sheath, where the solution is distributed fanwise. The needle is then passed into the subcutaneous tissue parallel to the skin surface, and infiltration made along the dotted lines.

With these preliminary general remarks, we may now pass on to the description of our method for producing 'splanchnic analgesia'.

TECHNIQUE.

Local Infiltration.—Raise five anæsthetic wheals: (1) The first, at the tip of the xiphisternum; (2, 3) The second and third, one on each side, at the level of the tenth costal cartilage, where the external border of the rectus crosses the costal margin; (4, 5) The last two, one on each side, on the external border of the rectus, a little higher than the umbilicus (*Fig.* 195).

The needle (8 or 10 cm. long) is then passed through each wheal in turn, and infiltration made fanwise. The deep layers should be infiltrated before the more superficial. The solution is injected within the rectus sheath (*Fig.* 196): this is quite sufficient to anæsthetize the underlying peritoneum, and gives a good relaxation of the abdominal wall. The infiltrated area should be lightly massaged to spread the solution within the tissues.*

* This technique, first introduced by BRAUN, VICTOR PAUCHET, and SOURDAT in 1914, is the one generally adopted for minor operations. Combined with that of splanchnic analgesia, it constitutes our method of regional anæsthesia in major abdominal surgery.

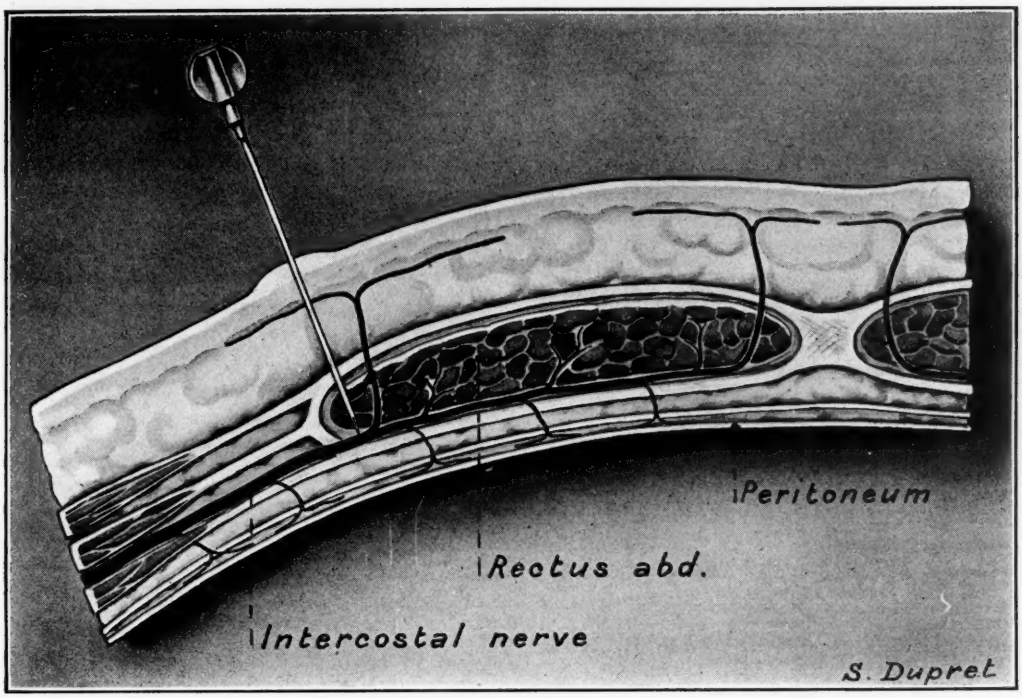

FIG. 196.—Cross-section of part of the anterior abdominal wall, showing the method of making deep injections within the rectus sheath.

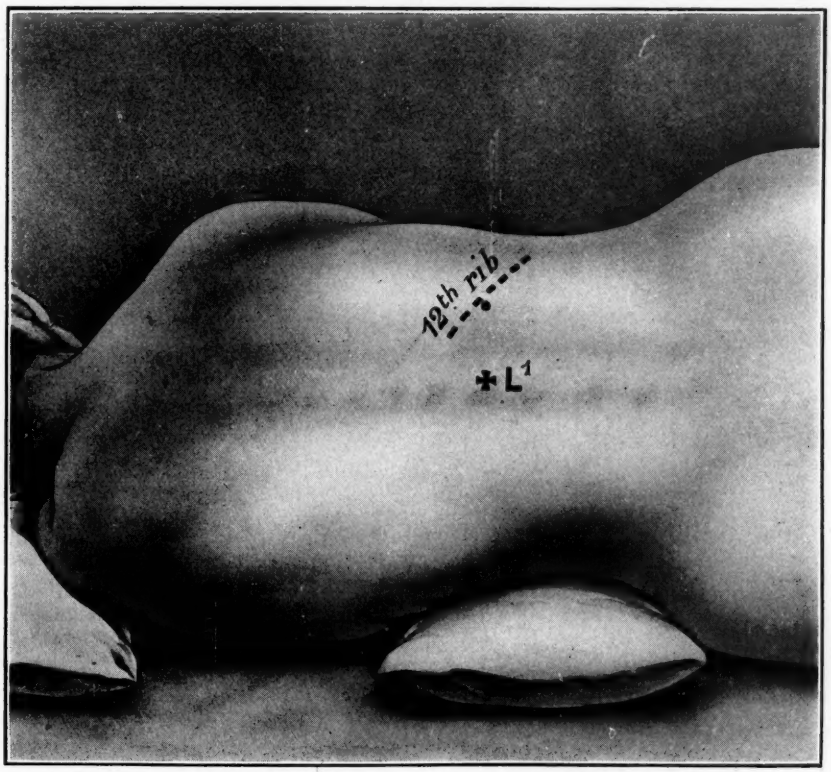

FIG. 197.—Position of the patient for splanchnic analgesia. The point just under the 12th rib marks the site of puncture, and the cross, vertically under, is the spinous process of the 1st lumbar vertebra. The distance between the two is four finger-breadths or 7 cm.

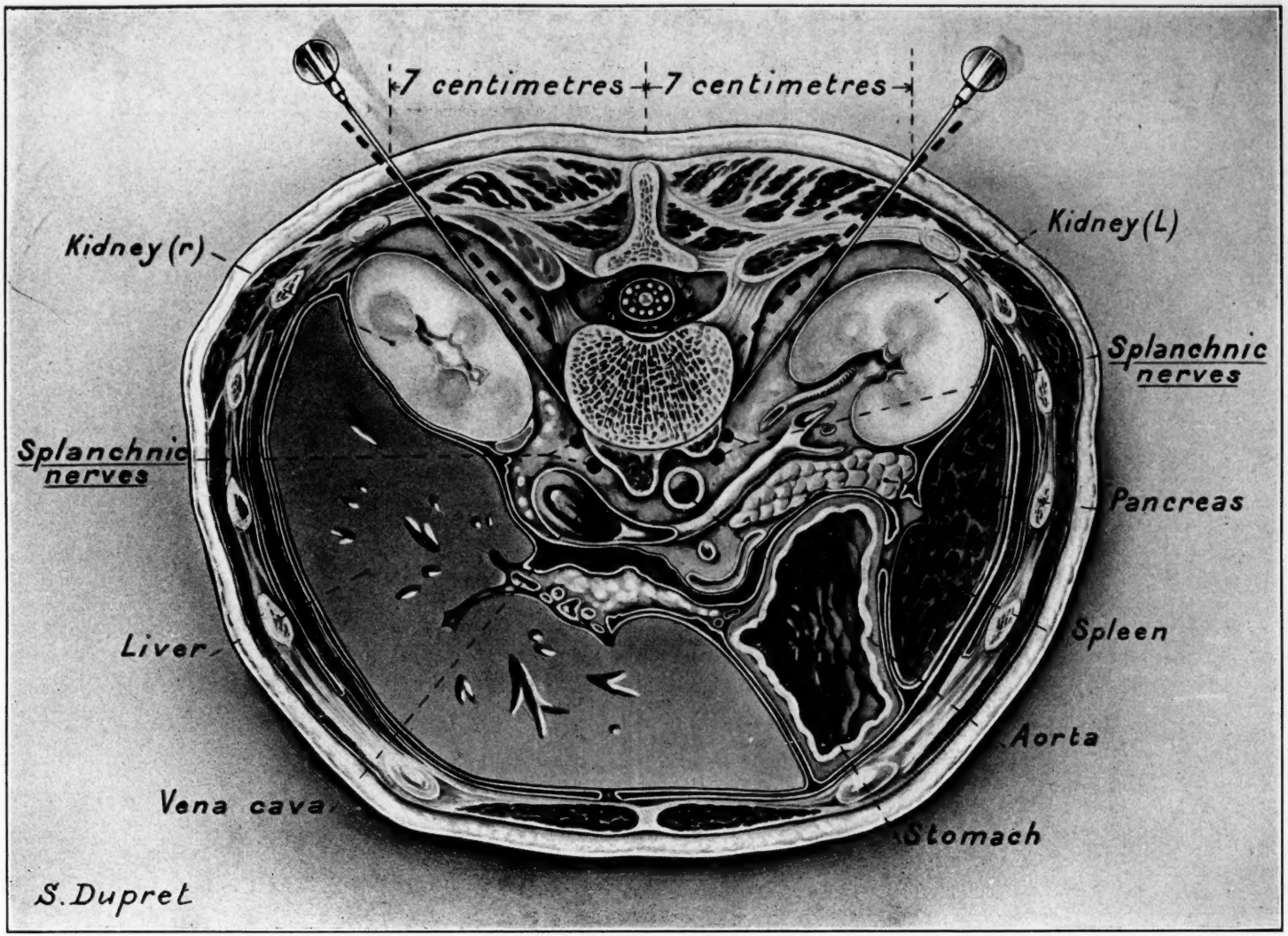

FIG. 198.—Cross-section through the 1st lumbar vertebra, showing the method of inducing splanchnic analgesia. The needle has been inserted on the lower border of the 12th rib, 7 cm. distant from the median line of the back. The dotted line marks the direction of the needle introduced towards the spine at an angle of 45° with the median plane of the body. Note its point of contact with the vertebra: the needle is here in its last and good direction: tangent to the body of the vertebra.

Splanchnic Analgesia.[4]—The patient should lie on his side with the back arched: '*position en chien de fusil*'. Place a cushion under the loin if the spine is too much bent sideways: the relaxation of the muscles thereby obtained renders the landmarks more accessible, and makes the subsequent steps of the technique easier (*Fig.* 197).

Define the 12th rib and the 1st lumbar spinous process. On the lower border of this rib, four finger-breadths or 7 cm. from the middle line of the back, raise an anæsthetic wheal, through which pass a *needle* 12 *cm. long*, along the horizontal plane of the body, i.e., vertically to the table on which the patient is resting.

Introduce the needle obliquely forwards, so that it makes an angle of about 45° with the median plane. Its point then strikes the body of the vertebra near its anterior convexity,* behind the splanchnic nerves, just where these join the semilunar ganglion. When the needle, introduced for about 9 cm., has struck the bone, it should be drawn back until its point lies in the subcutaneous tissue (so as to be able to change its direction), and reintroduced at a smaller angle. If its direction is good, the needle passes tangentially to the body of the vertebra (*Fig.* 198).

As soon as the point of the needle is felt to glide along the surface of the vertebra, it should be pushed in *one centimetre further*; and, after making sure that no blood comes out of the needle, inject at this level 25 to 35 c.c. of a 1 per cent novocain-adrenalin solution (novocain 1 grm., adrenalin 25 drops of a 1–1000 solution, and normal salt solution 100 c.c.). The patient is then asked to change side, and the injection is repeated on the opposite side.

The solution spreads easily into the loose retroperitoneal tissue, diffusing in all directions, reaching the solar plexus and its immediate tributary as well, thus anæsthetizing a wide area in which all operative manœuvres become painless. But we should not lose sight of the fact that novocain produces, beyond its field of action, a ring of hyperæsthesia, on which distant pulls may give rise to painful impulses, thus bringing about the tendency to believe that the technique has proved a failure.

RESULTS.

We have employed this method 34 times in various abdominal interventions, especially for gastric operations. Resections were performed in 24 cases by Prof. Victor Pauchet, with 21 good anæsthesias.

Operations	Anæsthesias		
	Good	Fair	Bad
Gastrectomy for ulcus	16	1	2
Gastrectomy for cancer	5	—	—
Balfour operation	1	—	—
Ileosigmoidostomy	3	—	—
Gastro-enterostomy for inoperable cancer	2	—	—
Radium application for inoperable cancer of stomach	—	1	—
Cholecystectomy	2	—	—
Cæcocolostomy	1	—	—
Total	30	2	2

We noted, either at the precise moment of injection or appearing a little later, a slight acceleration of the pulse, and, in one case, bilious vomiting with slight cardiac distress. These symptoms were of very short duration (two to five minutes), and were

* The anteroposterior diameter of the 1st lumbar vertebra measures about 7 cm. in the adult. The distance between the posterior extremity of that diameter and the point of introduction of the needle measures also 7 cm. These represent the sides of a right-angled triangle; and the needle, having been introduced at an angle of 45°, lies along the hypotenuse of that triangle, no allowance being made for the thickness of the soft tissues covering the spine.

followed by no untoward effects. In two instances a partial anæsthesia of the lower limbs was obtained, due probably to want of technique at the very outset of our experiments. The last series of 25 cases was gone through without the slightest trouble to any concerned.

The many difficulties attending the performance of complicated and extensive operations in the abdomen render it absolutely impossible to rely on the ordinary local method, though the poor and weakened conditions of some patients often urge on the surgeon the importance of inducing regional anæsthesia.

This method is easy, simple, and safe, and should be attempted as often as possible. With the hope that it may be tried with every chance of success, we have here endeavoured to give a clear description of our technique. The results we have obtained are very suggestive, and give a good idea of the possibilities of abdominal surgery under 'splanchnic analgesia'.

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BENIGN AND MALIGNANT CHANGES IN DUCT EPITHELIUM OF THE BREAST.

By Sir G. LENTHAL CHEATLE, London.

The evidence in support of the proposition which I put forward tentatively nearly fifteen years ago,* that cancer begins most commonly in the ducts of the breast rather than in the acini, has accumulated to such an extent, in my experience, that it should carry conviction to the minds of many who were disposed to be sceptical at the outset.

In a paper read before the Royal Society of Medicine on May 13, 1914, I elaborated the proposition by showing that cancer arises in cysts which are of duct origin. In a further investigation of this subject, in the October, 1920, number of this Journal, I was

Fig. 199.—Longitudinal section of a duct at its termination on the surface of the nipple. It is part of a whole section. The right half of the tissue forming the exit has turned over.

mainly concerned to demonstrate: (1) That breasts which are clinically described as cystic are dangerous; (2) That dangerous cysts are of duct origin; and (3) That the cystic origin of cancer leads to microscopical appearances which are diagnostic in character.

Before passing on to the main thesis of my present paper, I wish to prove, by photographs of sections, some statements made in my previous communication to this Journal.

First, I wish to add force to the urgency of protecting ducts from the entrance of living or lifeless irritants. *Fig.* 199 is a photograph of a duct opening on to the surface of a nipple. The orifice seems to invite the entrance of an irritant if presented at this part.

* *British Medical Journal*, 1906, May 26.

Far be it from me to make any positive assertion; but the appearances observed in the specimens I describe later, suggest to me a possibility that the cause, or part cause, of the diseases may gain entrance into the ducts through the nipple, and then initiate

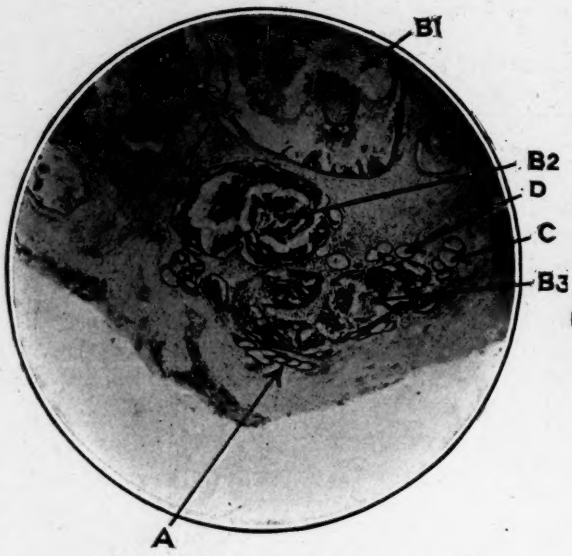

FIG. 200.—Ducts (A; B_1, B_2, B_3; C; D) whose convolutions make them appear separate as cysts when cut longitudinally.

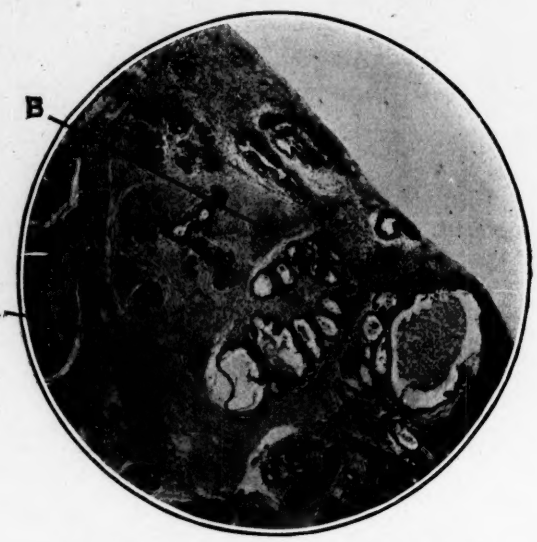

FIG. 201.—Ducts (A; B) cut nearly longitudinally and appearing as separate cysts, showing the same thing as previous figure.

pathological changes. Not only do the appearances suggest it, but the fact that only a few of the ducts are primarily implicated points in the same direction, and it could partly account for the localization of benign and malignant diseases.

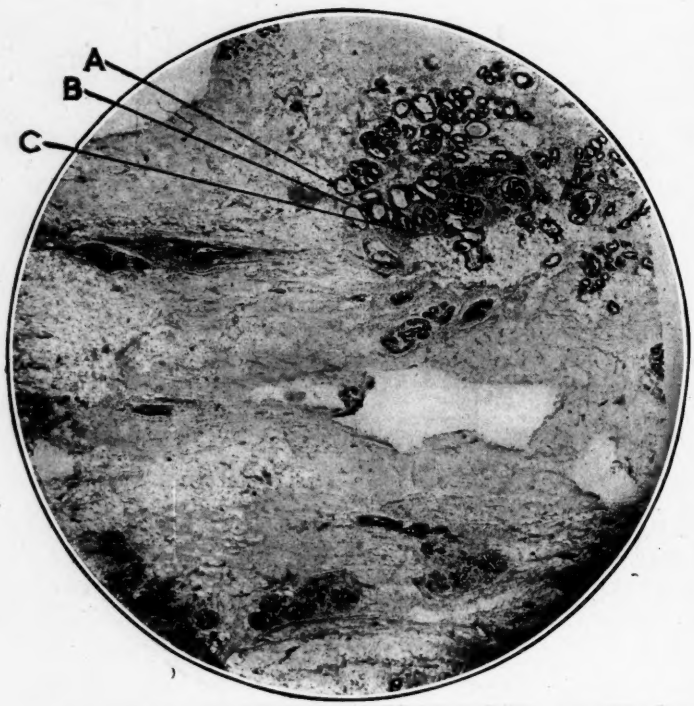

FIG. 202.—Duct which has divided into three convoluted branches, A, B, C, which have been cut longitudinally and give a false impression of being a collection of cysts.

Secondly, by means of serial sections I am able to show that duct cysts, whether they contain simple or malignant growth or no growth at all, must not be regarded as separate cysts, since they are parts in continuity of dilated and convoluted ducts: if they are cut transversely there may be the appearance of single cysts, and if cut longitudinally they may seem to be cysts in a row more or less straight. It may be contended, therefore, that the maintenance of my proposition involves the abandonment of the word 'cyst', but for the present it is more convenient to retain the common clinical nomenclature.

FIG. 203.—A section at the edge of a breast. It is the same section as represented in *Fig.* 100 in my previous article, but I have schematized the cysts into their component parts of ducts, from serial sections. There is 'infiltration' of the parts outside the ducts, at **A** for instance.

In *Fig.* 200 the five cysts at A are parts of one duct, so are the big cysts B_1, B_2, B_3, which are cancer-containing. The four cysts at C and the three at D are all parts of two ducts cut longitudinally. *Fig.* 201 shows five cysts at A and five at B that are

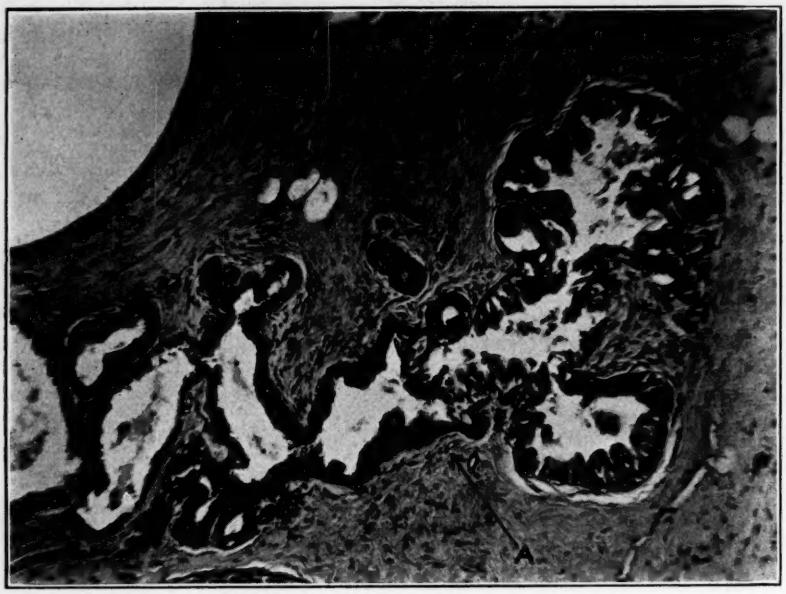

FIG. 204.—An acinous cyst. The duct epithelium is ending abruptly at the dilated acinus, the cells of which have become elongated and feathery. A, Termination of duct; B, Acinus.

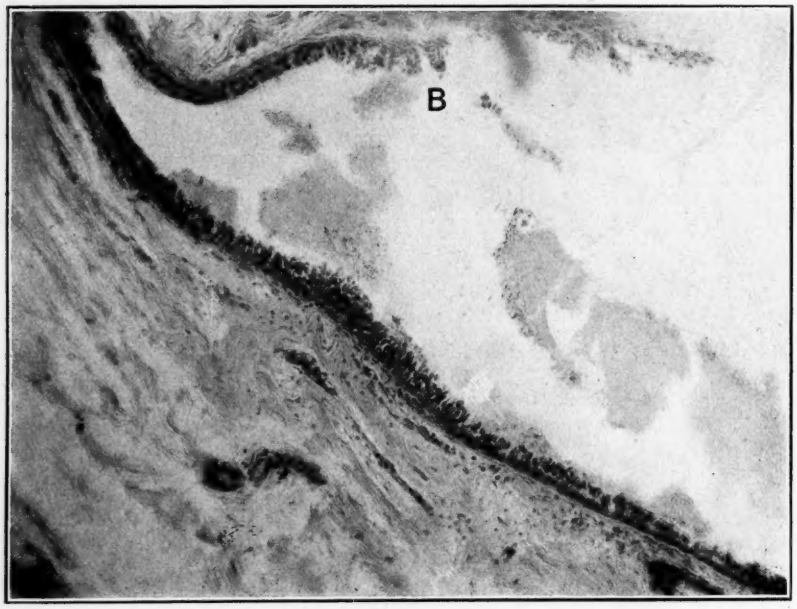

FIG. 205.—Part of a duct cut longitudinally. The epithelium has assumed the elongated and feathery appearance at B.

parts of two different ducts. Five large cancer-containing cysts in *Fig.* 221 belong to one duct. Three chains of cysts in *Fig.* 202 are three separate branches (A, B, C) of a duct that have been cut longitudinally and give rise to the false impression of being a

collection of about twenty cysts. And the great branching cancer-containing duct schematized in *Fig.* 218 gives rise to the false impression in those sections from which it was delimited as being full of separate cysts of various shapes and sizes. The cancer-containing cavities in *Fig.* 203 I have traced on lines which show them in their true light as being only parts of ducts. This section appeared as *Fig.* 100 in my previous paper. In the rest of the section there are cancer-containing branches of ducts I am unable to trace in this plane, and the rest of the specimen shows 'infiltration' only, at A and elsewhere. When once pointed out, it is obvious that duct cysts are parts in continuity of convoluted ducts, and the point needs no further demonstration.

FIG. 206.—Duct lined for the most part by normal epithelium. The epithelium lining the rest of it has undergone the elongated and feathery changes seen in the two previous figures.

Thirdly, I wish to illustrate my difficulty in determining, without the study of sections in series, the origin of those cysts containing the beautiful elongated feathery cells lining them and their papillomata. They might be either duct or acinus. *Fig.* 204, a photograph of a cyst delimited in serial sections, shows an acinous cyst. It is terminal, and the duct epithelium is ending abruptly when the acinus is reached. *Figs.* 205 and 206 show ducts lined in parts with the same feathery elongated cells; and they explain my difficulty in determining the origin of a cyst lined by cells of this kind without confirming the evidence by means of serial sections.

FIG. 207.—A simple papilloma growing from the wall of a duct. It is the only duct papilloma to be seen in a large cystic breast from which whole sections were cut.

The thesis of my present paper I divide into two parts. *Part I* demonstrates the great variations in the number of benign duct papillomata that may be contained in breasts. *Part II* deals with primary malignant disease in ducts. A comparison is drawn, where possible, between the tumours referred to in the two parts.

Part I.—BENIGN DUCT PAPILLOMA.

A.—*Fig.* 207 is a photograph of a benign duct papilloma, the only tumour I was able to discover in whole sections made from a cystic breast. Its presence was totally unsuspected clinically. This specimen I take to be a

benign affection which is represented as malignant disease in two breasts containing single tumours of duct cancer which I shall describe later.

B.—Fig. 208 shows a cystic breast (kindly sent to me by Mr. Sampson Handley for examination) in which two ducts, distributed on opposite sides of the breast, are full of multiple papillomata throughout their courses from the periphery at E E to the nipple at C. Most of these papillomata are benign, but in three separate parts the duct contents are cancer from which the surrounding small isolated areas of cancer have been derived. There was an occasional discharge of blood from two ducts. The papillomata varied in size. The two biggest existed in ducts below the nipple, A and B (each of which may be situated in a dilated ampulla); below this the variation in size was not great —they were microscopical. Macroscopically, the larger of the two above mentioned was a soft diffluent mass whose fine and beautiful papillomatous structure became obvious only on microscopical examination. In some of the cysts the branches of neighbouring

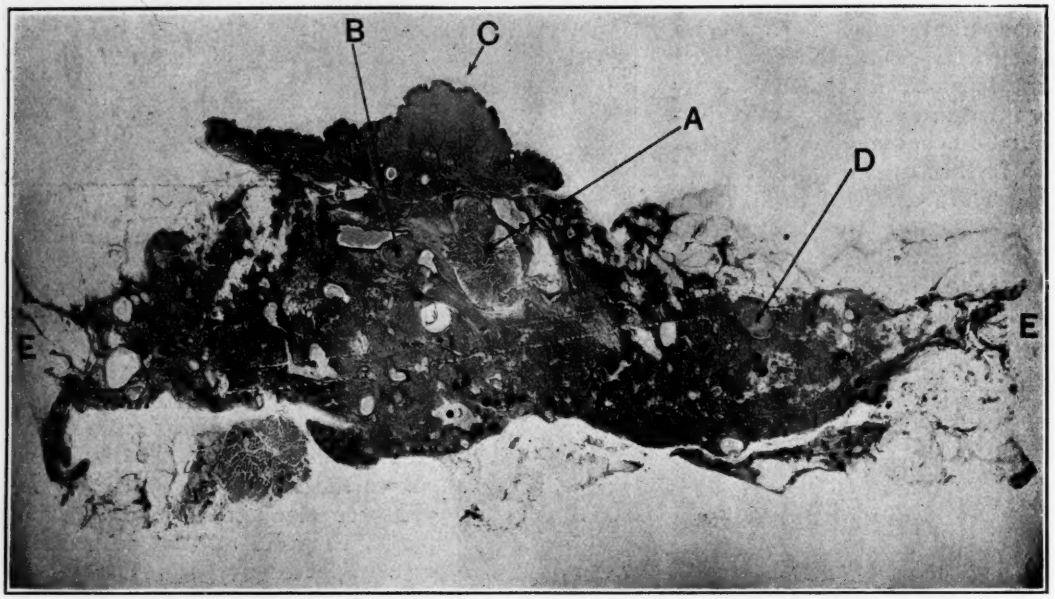

FIG. 208.—A whole section of breast in which more than fifty simple papillomata can be counted. The biggest are A and B. The rest are microscopical; I have marked their situations by dots. Over twenty sections of this breast have been cut, and two ducts so far appear to be mainly concerned in the tumour-growing process; the examination is incomplete. The biggest papillomata (A and B) may be in dilated ampullæ of the duct. C, The nipple. EE marks the periphery of the breast.

papillomata coalesced and formed arches over the underlying normal columnar cells lining the ducts. In some parts the papillomata appeared to possess no central fibrous tissue where they sprang from the walls of the duct, and looked as if branches of papillomata had dropped on to the walls of the duct and their epithelium had coalesced with that lining the ducts. There are more than 70 papillomata. The enormous number of tumours contained in the ducts of this breast form a striking pathological picture. The specimen from which *Fig.* 208 is reproduced I take to contain mainly a benign affection which is represented as diffuse malignant disease in many breasts I shall describe later.

I shall allude to this specimen again, because it contained cancer.

For the purposes of this paper I take the two breasts shown in *Figs.* 207 and 208 as examples of the two extremes in which the gland may be affected by benign papillomata. The reader must bear in mind that there are other breasts in which the number occupies an intermediate position between these two extremes.

Part II.—PRIMARY DUCT CANCER.

In all the specimens I am about to describe, the lymphatic system was invaded by 'infiltration'; in many of them the axillary glands were affected.

A.—First I shall describe two very similar tumours which existed in two patients. They are the only signs of primary tumour formation to be observed. They are very large, and are composed mainly of structures papillomatous in type, but the laciform type I described in my previous article can be observed in minor degree.

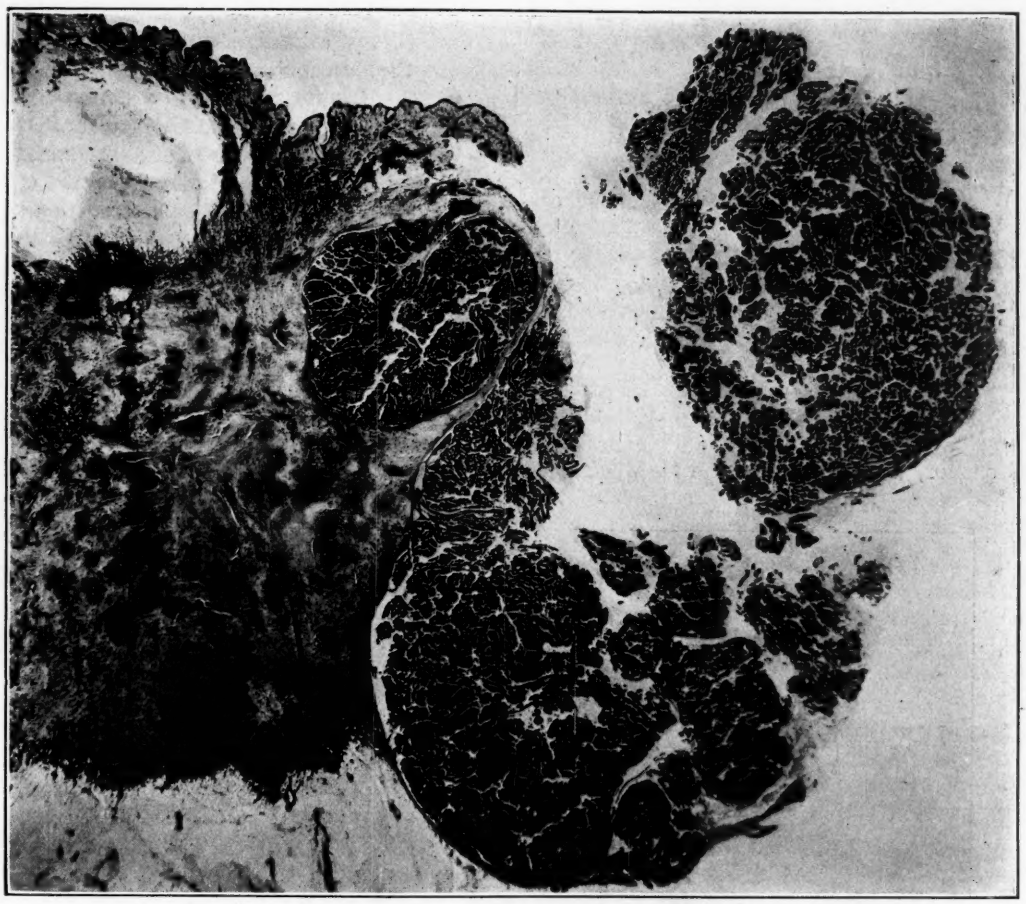

FIG. 209.—Whole section of breast. A large duct cancer occupies the right of the specimen, and an extensive area of 'infiltration' is seen on the left.

The first specimen is shown in *Figs.* 209, 210, 211. *Fig.* 209 shows the tumour on the right, and its 'infiltration' of the lymphatic system on the left. *Fig.* 210 is a high-power photograph of the tumour. *Fig.* 211 is a high-power photograph of the 'infiltration'. The last shows well what always occurs when this and all other forms of duct cancer 'infiltrate' the lymphatic system: they lose their columnar shape, and become 'spheroidal', 'cuboidal', etc., and show no signs of a papillomatous arrangement; this appears to me to be so definite a fact that I need not allude to it any further; it may be taken that the 'infiltration' of all duct cancers which I have observed behaves in the same way.

The second specimen, *Fig.* 212, is the only sign of primary growth in this breast. There is 'infiltration'. Under low power the structure and fabric of this tumour appear

identical with the first specimen, but under high power the cells in most of its parts, even in the tumour itself, have lost all except a hint of their columnar type. In some parts, however, at A for instance, they are definitely and unquestionably columnar. This specimen indicates that the columnar cells in a primary duct cancer growth itself may undergo reversion to a possibly lower type, 'spheroidal', 'cuboidal', etc., in shape.

FIG. 210.—High-power photograph of the tumour seen in *Fig.* 209.

I take these two specimens as representative of a malignant type comparable with the non-malignant type in *Part I, A*.

B.—I now attempt to demonstrate two facts, or what I conceive to be facts: (1) That the primary cancer process transforming epithelial into malignant cells may commonly operate on extensive duct surfaces, and in doing so resembles in malignant disease the multiple papillomata of a non-malignant disease (*see B, Part I*). (2) That having been established at one part of a duct, it may affect other parts of it, or other ducts. The latter point shows that I propose to suggest a genetic process in the spread of cancer, in addition to the 'infiltrating' and 'permeating' processes in the lymphatic

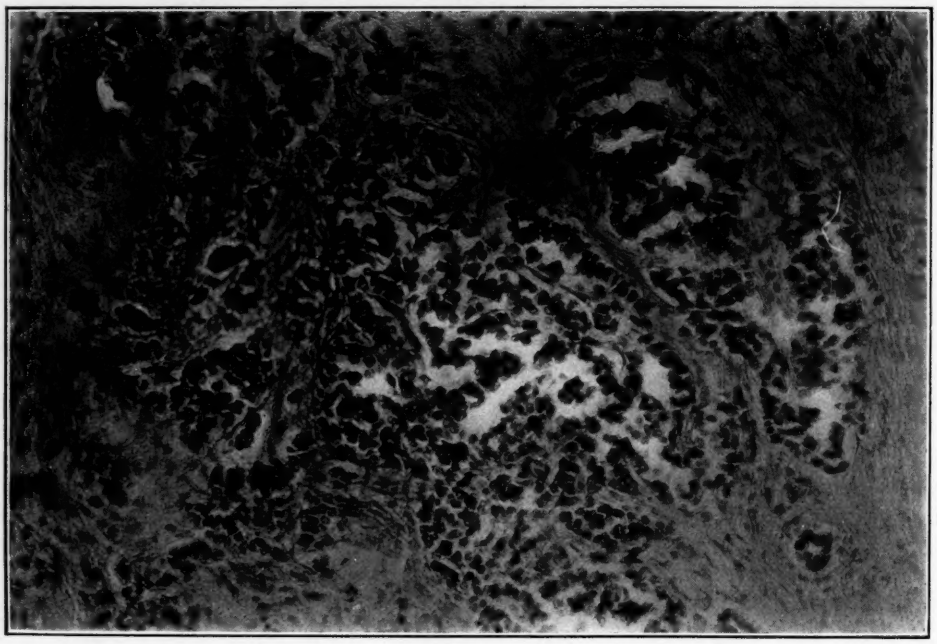

FIG. 211.—High-power photograph of the 'infiltrated' area seen in *Fig.* 209. The epithelial cells have lost their columnar shape, and are 'spheroidal', 'cuboidal', etc. There is no papillomatous formation in the area of infiltration.

system. The appearance contra-indicates the suggestion that all the cancer observable in these breasts started simultaneously.

I shall allude to appearances in the ducts that cannot be explained away by saying that under examination they are merely acting as pathways to accommodate an on-growing tumour, or that a portion of a pre-existing tumour has been grafted on a fresh site within the ducts, and that what is seen is merely a mass of shed and desquamated epithelial cells filling the ducts. I recognize that the strongest criticism that might be levelled against my interpretation of the facts would be that what I am about to describe is not cancer. Therefore it is necessary for me to state that metaplasia from normal into this disordered cell-growth can be observed in the ducts, that it 'infiltrates' the lymphatic system, and that it causes death. And whole sections of these breasts do not reveal any other possible primary lesion from which the spread in the lymphatic system could have emanated.

Figs. 213–217 show some of the whole sections of the breast from which I described the course of the cancer-containing duct on page 158 of my previous article. It will be understood that the distribution of the duct and some of its branches can be described only in the vertical plane. *Fig.* 218 is a diagram of this duct. It is also obvious that I am not in the least straining the imagination in assuming there are other branches, incapable of being schematized in this plane, which must be also cancer-containing. It is impossible to conceive that I have accidentally hit upon only that duct and its particular branches that are cancer-containing. I believe that the spaces filled with cancer at L_1, L_2, L_3, L_4, L_5, L_6, in *Fig.* 217, for example, are all cancer-bearing ducts cut more or less transversely. Take, for instance, three cysts of this series (*Fig.* 213, C_1, C_2, C_3); I am able to show that they belong to part of one duct. They all point to the correctness of my belief. The cancer contents of some of the cysts which are parts of the main branches of the duct have fallen out during the preparation of the sections; fortunately they have not been disturbed in the same parts in all the sections, hence it can be stated that all are cancer-containing. Take the cyst at *Fig.* 213, L_6, for example; here it is cancer-containing, but the growth has fallen out in the same cyst L_6 in *Fig.* 217. When one looks at *Fig.* 219, a photograph of a terminal distribution of a normal duct, one is appalled by the extent of epithelial surface that can be affected if the primary cancer process can be associated with duct distribution.

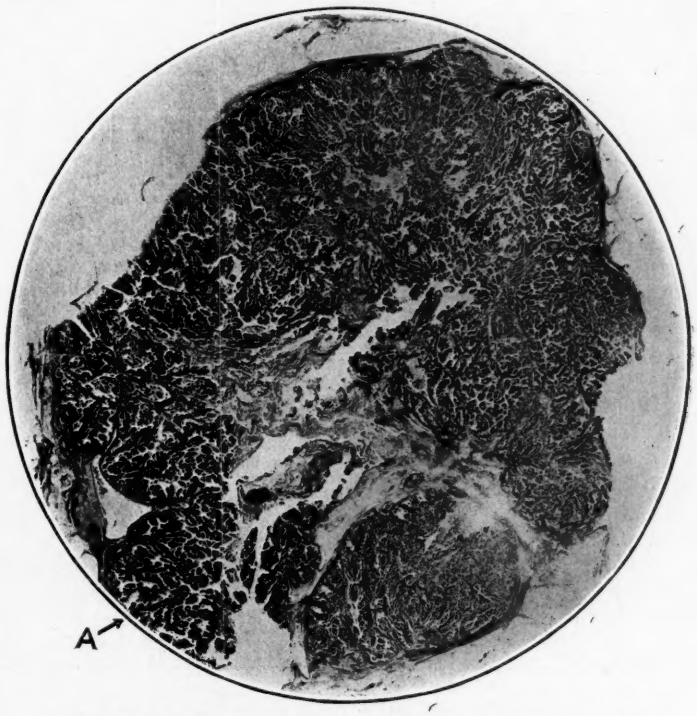

FIG. 212.—Whole section of breast which contains a duct cancer similar in general structure to that shown in *Fig.* 209. The papillomata are not lined in this tumour by typical columnar cells except occasionally—at A, for instance. In other parts they are lined by cells which are 'spheroidal' in shape or not quite columnar.

Figs. 213–217 are photographs of whole sections of a breast in which the left half is cancerous and the right half fairly normal, though a few small cysts can be observed at the periphery of some of the sections. To reproduce the whole series would be impossible.

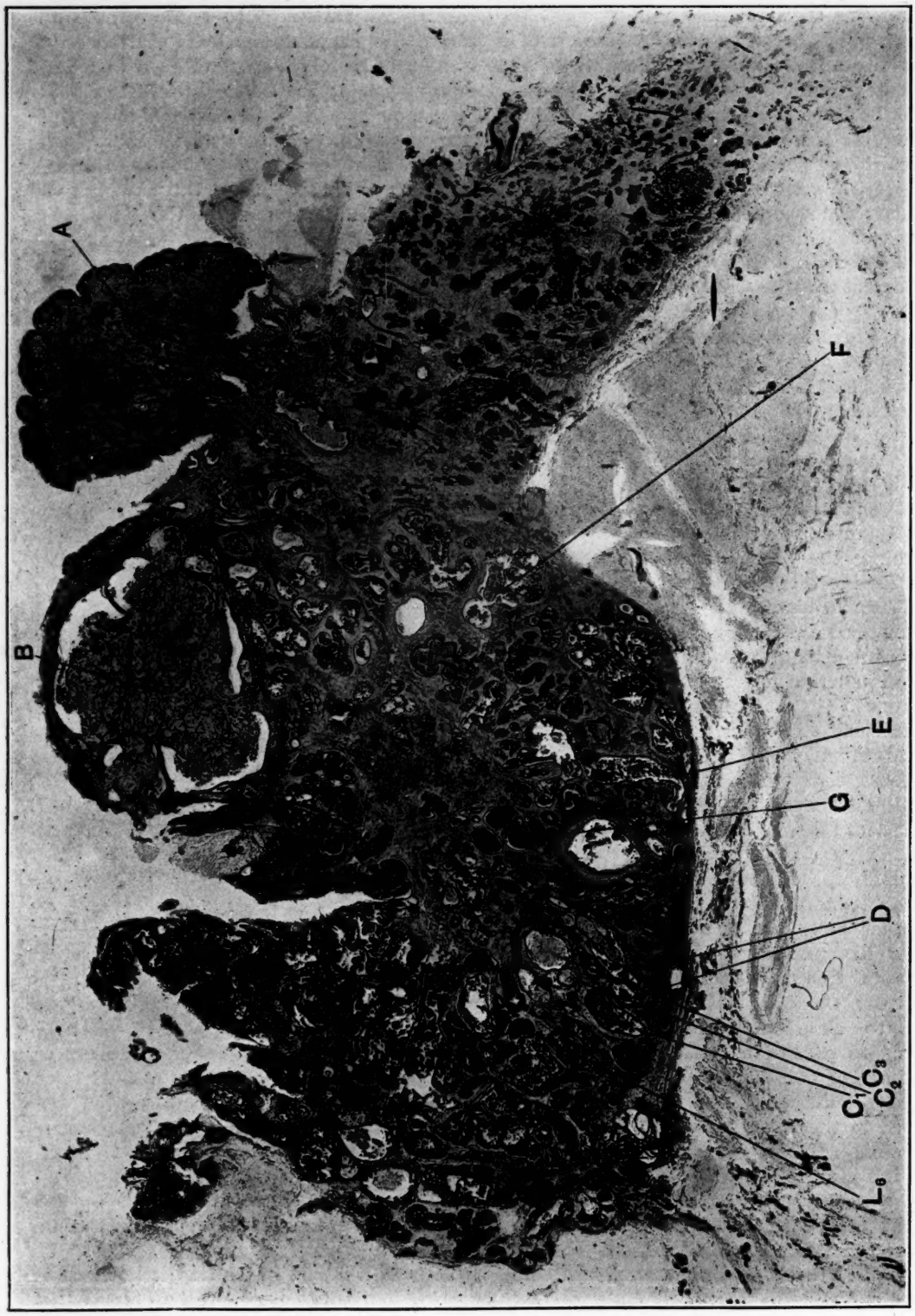

FIG. 213.—Whole section of a breast. **A**, Nipple. Cancer occupies the left half of the breast. 'Infiltration' has occurred in centre. The right half is fairly normal. **B** marks a portion of growth in colloid degeneration; it occupies the termination of a duct, and is probably dilating its ampulla. This photograph is the first of the series which contains the cancer-bearing duct schematized in *Fig.* 218. It is desired that the cysts marked **D, E, F, G, H, I,** should be followed in this figure and in *Figs.* 214, 215, 216, and 217.

FIG. 214.—Later section to *Fig.* 213.

FIG. 215.—Later section to *Fig.* 214.

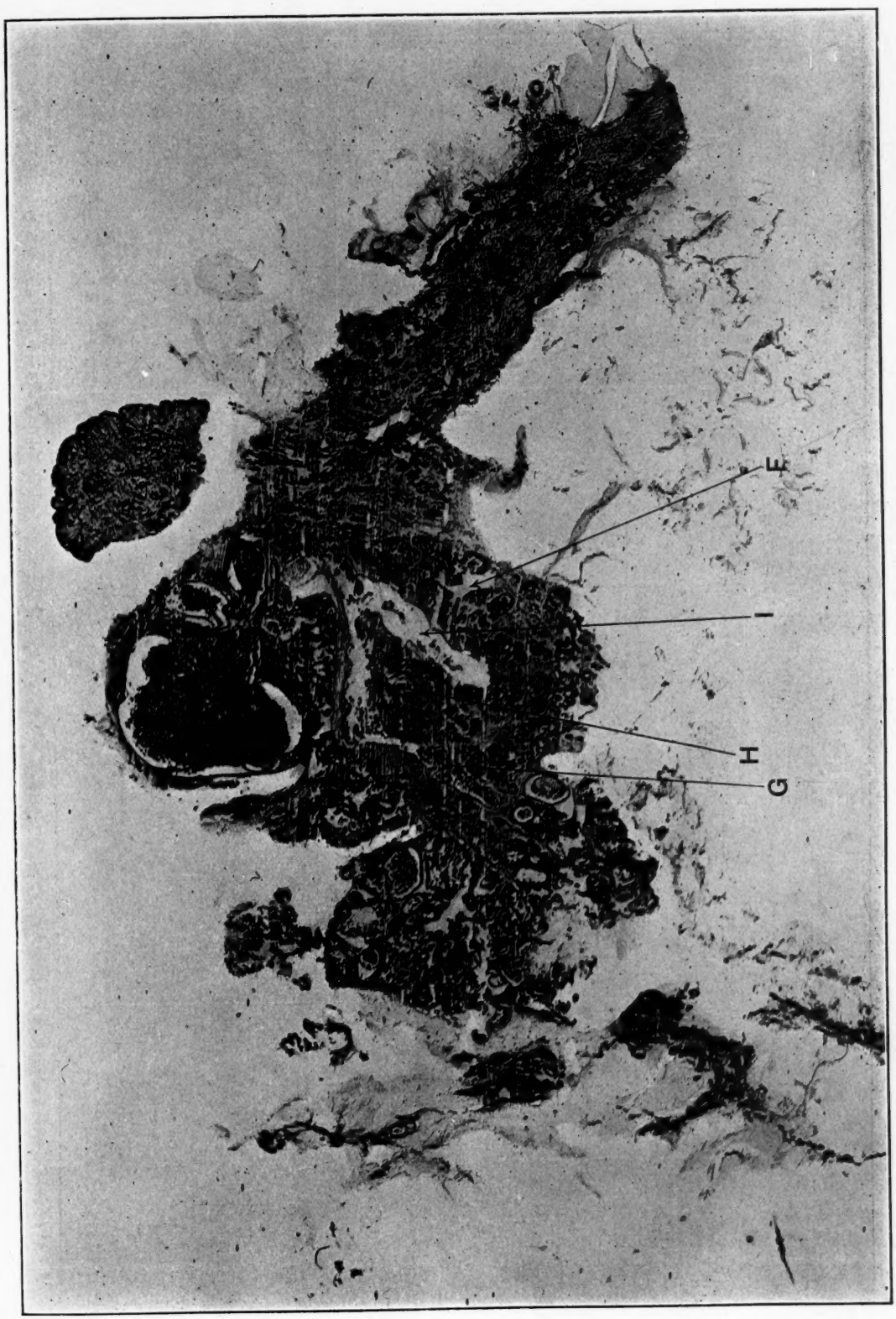

FIG. 216.—Later section to *Fig.* 215.

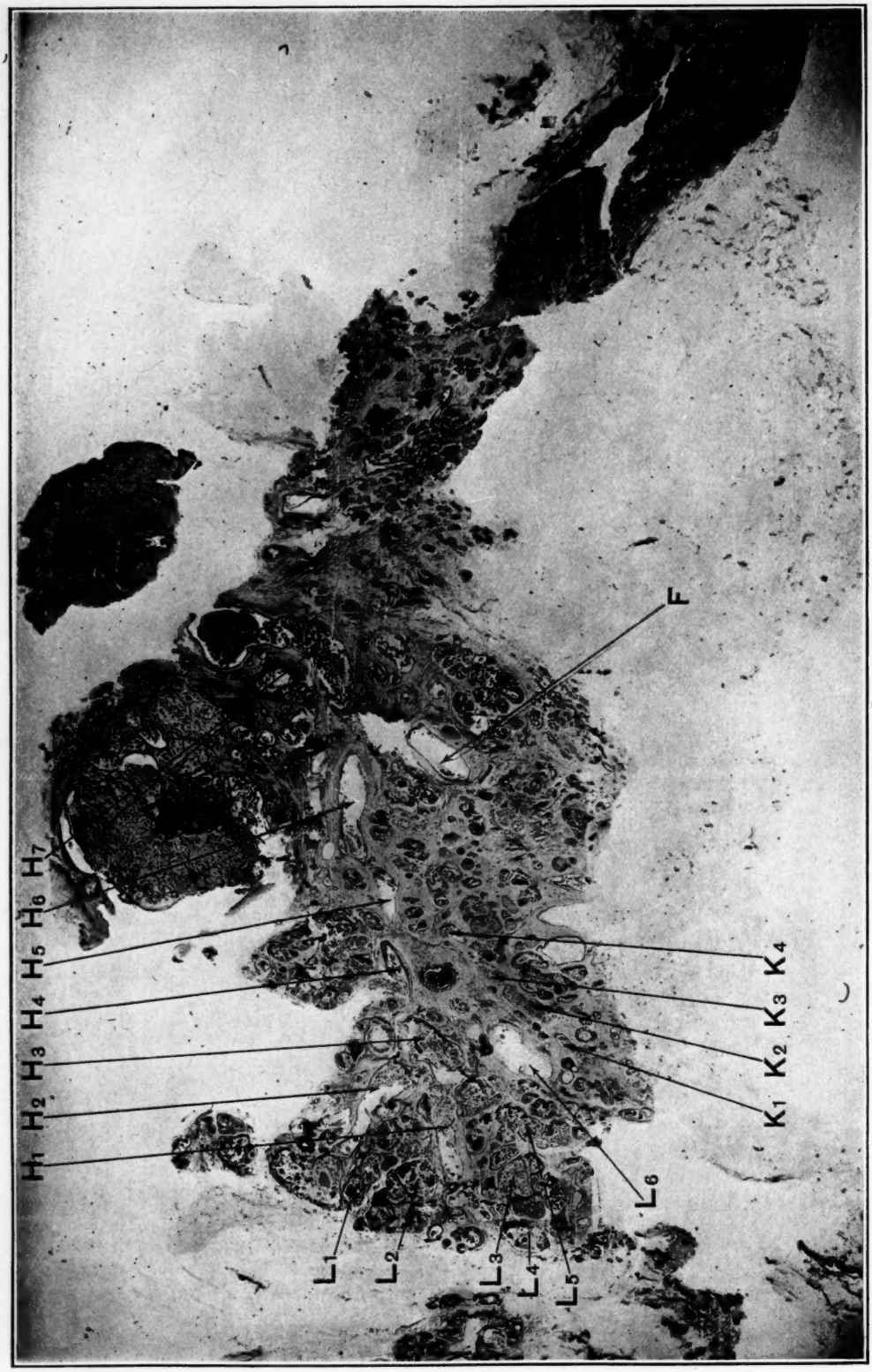

FIG. 217.—Later section to *Fig.* 216.

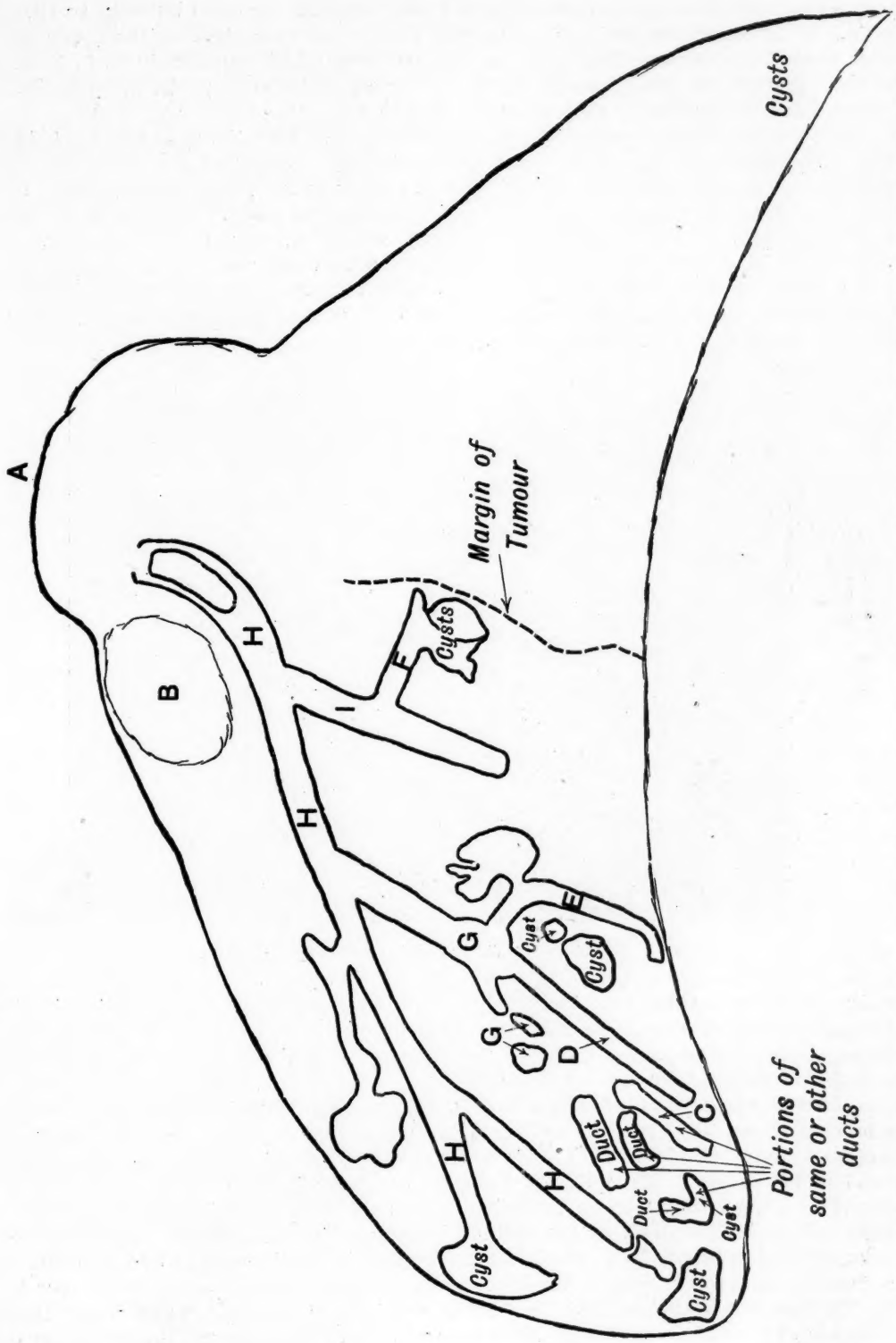

FIG. 218.—The cysts C, D, E, F, G, H, I, shown in *Figs.* 213–217, are here assembled in diagrammatic form, and represent that portion of the cancer-bearing duct which lies in the plane vertical to the nipple.

Now I will help the reader to trace for himself the duct schematized in *Fig.* 218. To save over-description of each photograph I have applied the same lettering to the same cysts. If he has time and inclination, the reader can then develop the course of this duct from the pictures. The cysts to observe are marked respectively D, E, F, G, H, I. In those pictures in which the letters do not appear, the main parts. being in different planes, have disappeared. They are assembled in *Fig.* 218.

Having described this duct, I would point out again that the spaces at L_1–L_6 in *Fig.* 217, also the cysts K_1–K_4 in the same figure, are all dilated ducts full of cancer, more or less in transverse section, which belong either to the branches of the duct I have schematized, or other ducts all of which occupy a different plane. In support of this conception I would ask the reader to imagine the branch of the duct E in *Fig.* 213 cut transversely, not longitudinally: it would exactly resemble those spaces at L_1–L_6 in *Fig.* 217.

I desire to draw particular attention to the cancer of the breast from which this cancer-containing duct is schematized in *Fig.* 218. The outstanding feature is this: In no part of the course of this cancer-containing duct and its branches does the contained

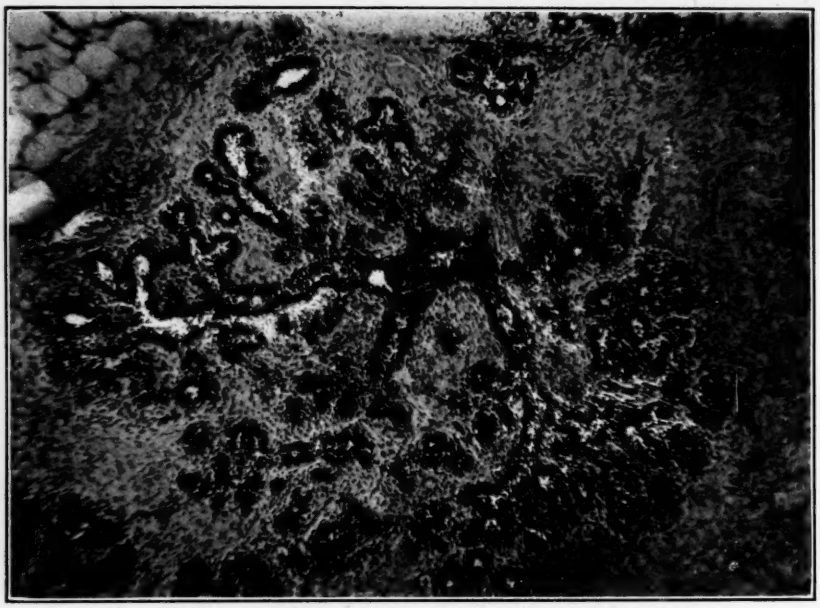

FIG. 219.—Duct distribution close to its termination.

malignant growth appear to be merely an on-growing tumour spreading in the ducts. Throughout the course of the duct and its branches the epithelial cells constituting the lining appear to be the victims of the primary cancer process. The cancer appears springing diffusely from the epithelial lining.

Now let the reader look again at *Fig.* 203. It is a photograph of the periphery of a breast. From the few serial sections I have of it I have traced lines which show that the cysts are parts of ducts. These ducts are full of growth actually springing from the walls of the ducts. The epithelial lining of the walls is itself malignant. This is no spread of tumour, but it is an extensive process affecting the epithelial cells of the duct walls. It is a metaplasia of the epithelial lining. I could discover no other lesion in any part of this breast from which the infiltration in the lymphatic system could have been derived. It is important to observe in this breast, and in the specimen sent to me by Mr. Sampson Handley, that the 'infiltration' starts and radiates from the terminal branches of the cancerous ducts. Here the walls of the ducts are not surrounded by dense fibrous tissue (*see Fig.* 219), and 'infiltration' must be easy.

It is interesting to draw attention to the whole section of the breast in *Fig.* 220. Two parts on opposite sides of the breast are affected with duct cancer. It is quite possible (in fact I have already suggested the opportunity) that serum containing living cancer cells might have escaped from the ducts communicating with the cancer at A, and,

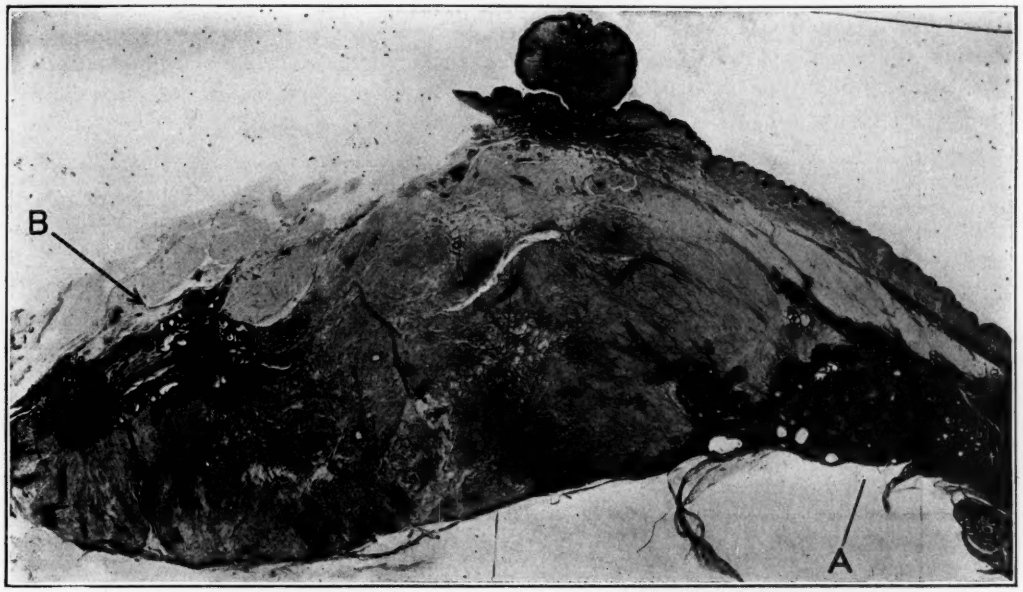

FIG. 220.—Whole section of breast. Cystic duct cancer at A, and another focus of same disease at B. The focus at A was that which attracted all the clinical attention. The focus at B was not discovered in a careful clinical examination.

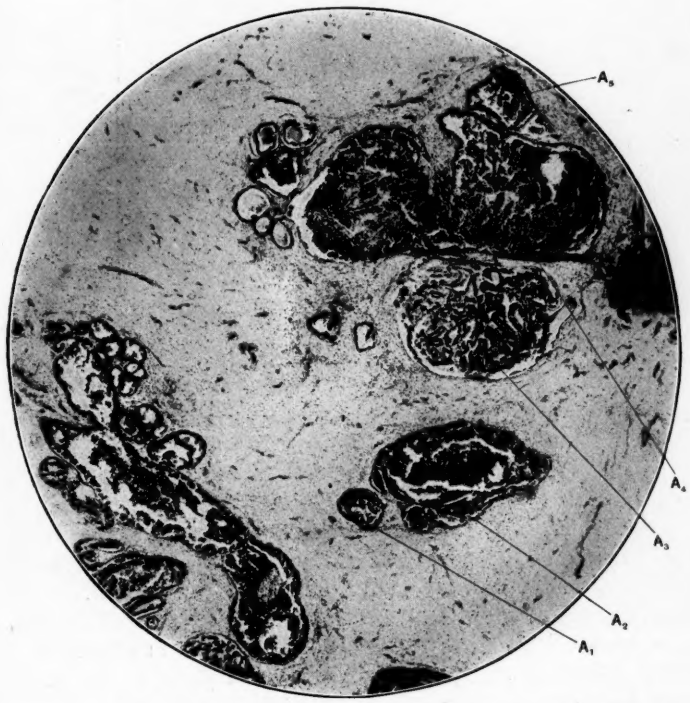

FIG. 221.—Cancer-bearing duct taken from A, *Fig.* 223. A_1–A_5, Cysts which are parts of one duct.

having reached the nipple, then entered the ducts communicating with the cancer at B, and, conducted by them, formed the grafted cancer at that part; but granting that possibility, it does not seem to be the explanation; the appearance compels one to think that there is a process in operation which is inducing primary cancer in duct cells of the part. Nor can it be that cancer has reached the position B by an extension in the lymphatic system; for it is not in the direction of lymphatic channels, and there is no indication of a lymphatic spread from A to B. There is at B a primary cancer change in the cells of the ducts. The only way in which the duct cancer at B could have been

induced by a problematical extension along the lymphatic system from A is that cancer, having thus reached the ducts at B, has burst into them, liberated the cause or part cause of cancer, and set up a primary cancer of the duct epithelium. From appearances I would prefer to argue that no graft, merely as such, had traversed the duct from the nipple, but rather that the cause or part cause of cancer had taken that course and set up cancer at B.

To the question—Are not the dilated ducts full of merely shed epithelium?—the answer is quite clear; it requires only a moment's observation of the ducts and the breast under this suspicion to convince one that the assumption would be quite contrary to facts. This is seen in *Fig.* 221, a photograph of a duct taken from A in *Fig.* 223. In

FIG. 222.—High-power photograph taken at B, *Fig.* 223. Malignant character of growth is to be observed.

these cysts I admit there is desquamated epithelium; so there is in most cancer tissue; there is in the primary focus at C, *Fig.* 223; but there is also in this duct A that which is more important, a papillomatous malignant growth, and many cysts around it are in an early stage of cystic cancer, in which actual metaplasia of the epithelium into malignant disease is occurring; this is also taking place in the ducts B_1, B_2, B_3 in *Fig.* 223.

It is the fact that ducts of this breast (and others) show the primary cancer process in different degrees of progression that compels me to assume that there is probably a gradual process by which primary cancer is being initiated elsewhere than at the more extensive and presumably primary focus.

The clinical and pathological observations of the disease in the woman seen in *Fig.*

224 are striking. The tumour that called the attention of this patient to her breast is seen above and outside the left nipple. Its situation, defined margin, comparatively recent appearance, and a history of a discharge of blood from the nipple, persuaded me

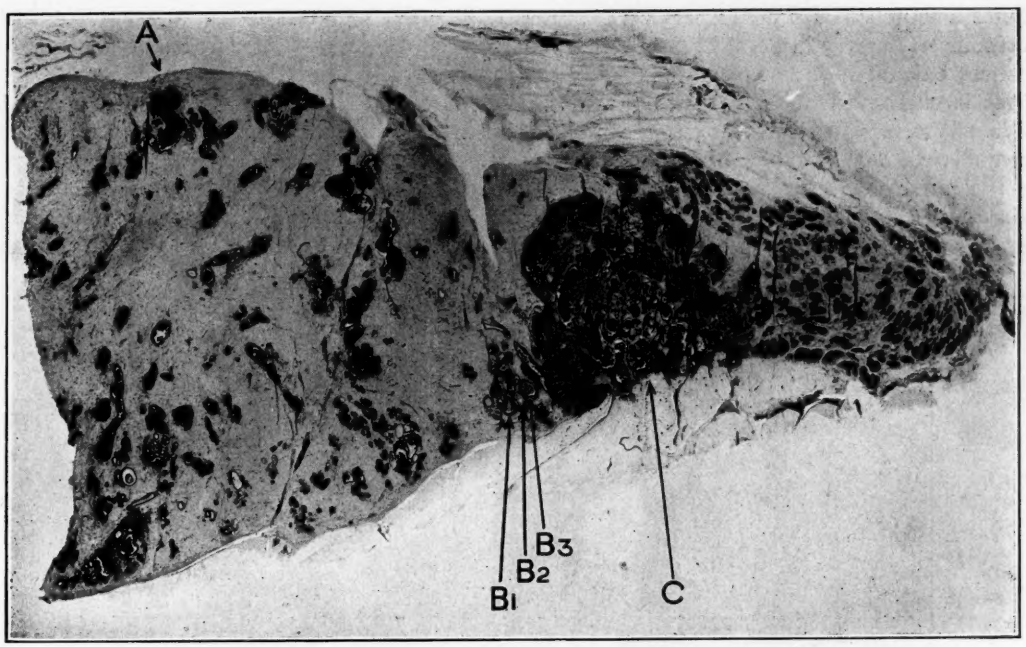

FIG. 223.—Duct-cystic cancer in a breast at C. Cancer-bearing cysts are seen at B_1, B_2, B_3, and cancer-bearing ducts in region of A. *See Fig.* 221, A_1–A_5.

to diagnose this tumour as a duct cancer. I could feel no glands in the axilla, though they were affected with cancer. The whole section of the breast was cut, and is seen in *Fig.* 225. On examination the tumour near the nipple was seen to be clearly only a spread in the lymphatic system from some other source. It was not connected with the nipple, which it merely pushed on one side. It struck me that this could not be the cause of the blood discharge from the nipple. I examined the ducts farther down in this section, and at C found a duct cut through transversely full of growth (*Fig.* 226), but nowhere else in the section could I find disease, except for the presence of a large duct adenoma seen on the right in *Fig.* 225. Fortunately the rest of the breast had been kept, and on digital examination I discovered part of it that appeared more dense than the rest. I determined to cut sections of this part. On

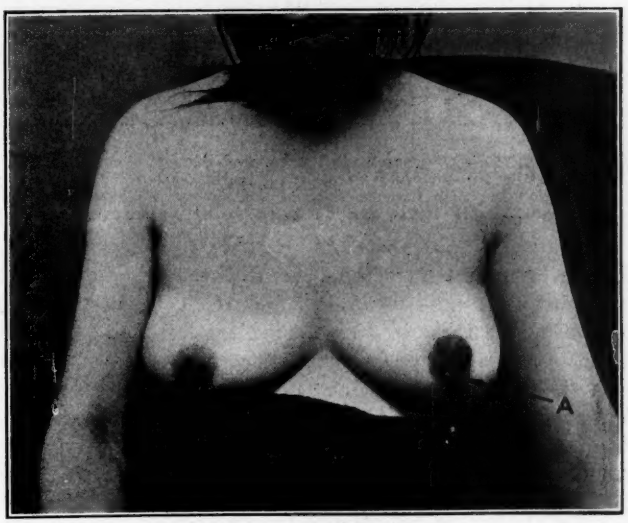

FIG. 224.—Photograph showing cancer of left breast. The tumour that attracted the patient's attention is situated above and outside the nipple. This tumour was merely the lymphatic 'infiltration' which has occurred from a deeper primary focus (at A) that was clinically undiscovered. There were glands implicated in the left axilla.

microscopical examination I found all the duct-cystic elements I described in my previous article, and also a spread in the lymphatic system outside them (*Fig.* 227). The latter corresponded in every way to the affected lymphatics in the tumour near the nipple.

The area affected in the deeper parts of this breast was an extensive one, affecting quite a fourth of the outer part of the breast. It was from this region and not from the tumour near the nipple that the blood from the nipple came. A large area of primary cancer existed in this breast that gave no clinical evidence of its presence. I am afraid that is characteristic of cancer that arises extensively in ducts. This and the breast in *Fig.* 221 demonstrate that comparatively large areas can be affected with cancer without any clinical sign of its existence being manifest.

I must draw the reader's attention again to the breast sent to me by Mr. Sampson Handley (*Fig.* 208). I have said before that it contained multiple benign papillomata in two ducts. Now I point out that branches of those two ducts contained cancer.

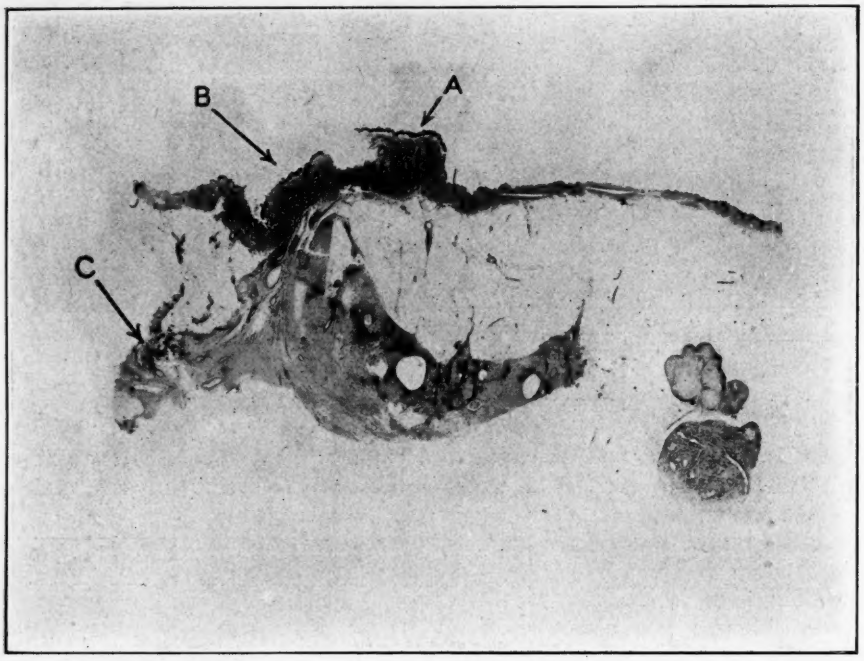

FIG. 225.—Photograph of whole section of breast seen in *Fig.* 224. The whole of the lymphatic infiltration at A has not been reached in this section. B is the nipple, which has been pushed on one side. The arrow C points to the situation in which was found a duct containing malignant growth (see *Fig.* 226 A). No other marked disease appeared in this section, except that on the right there is a large duct adenoma.

These branches were situated at three widely separated parts of the breast, one at the periphery on opposite sides, and the third at the periphery in the middle line. Each led directly into isolated foci of 'infiltration'. *Fig.* 228 is a photograph of the incriminating duct on the left periphery.

Before ending the description of these breasts, I must point out that the primary cancer in *Part II, A*, is more papillomatous than that in *Part II, B*, where it is more laciform in character. The diffusely distributed papillomata in *Part I, B*, are attached to the lining walls by more sessile stalks, and there is more branching. In fact they approach a condition, in many parts, of less benign appearance.

A paper of this kind can be made of practical value to the clinical observer if one is able to indicate therein a possibility of diagnosing a duct-cystic origin of the disease under his observation. This is indeed possible, but as a rule only when the disease has not run riot in the lymphatic system; it is that riotous spread that gives rise

to the attachment to the skin, producing the ominous 'puckering' which may obliterate all clinical and even microscopical evidence of its origin.

For the purpose of diagnosis I would call attention to the following points. A patient's idea of the time passed since she first noticed the lump in her breast is

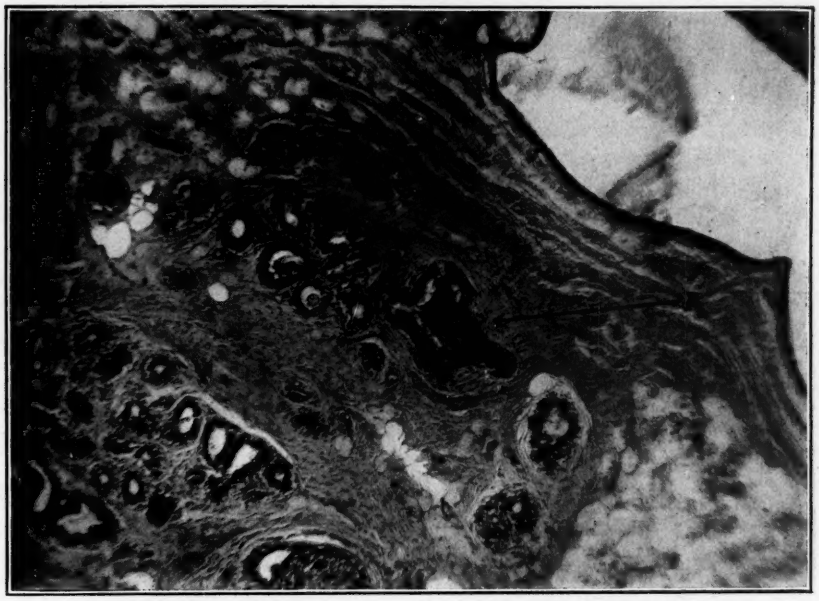

FIG. 226.—A high-power photograph of duct indicated at *Fig.* 225 C.

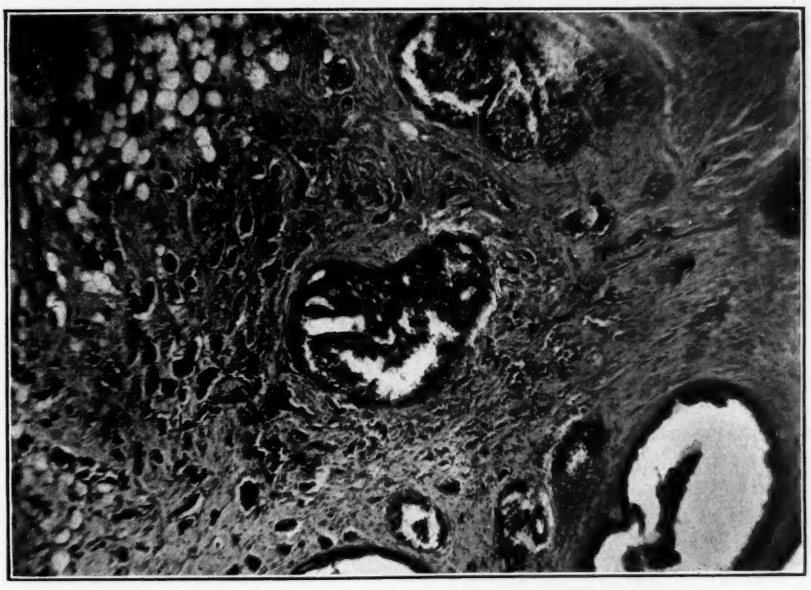

FIG. 227.—High-power photograph of cystic cancer process and 'infiltration' of lymphatic system from site shown at A, *Fig.* 224. The disease was extensive. It had not reached a stage to be discovered during a careful clinical examination. The cysts contained the 'laciform' structure described in my previous article.

often inaccurate. Her statement of a discharge of blood or clear fluid from the nipple is trustworthy. A large or a small solitary solid tumour not puckering the skin may be a duct adenoma, a sarcoma, or duct cancer; enlarged glands in the axilla would justify

a diagnosis of the last, and were it coupled with a discharge of blood or serum from the nipple this would more definitely confirm the diagnosis. The malignancy of this type varies enormously. It is always important, but in some cases it may be intensely malignant. Cancer in two breasts of the same patient, although not a common occurrence, is very well known to exist. In those patients where it has existed, and whose breasts I have been able to examine, the cancer has been of the duct-cystic type in both breasts. A very disheartening thing is the fact that breasts described under *B* in *Part II* can be in a state of advanced cancer with no definite clinical signs to indicate its presence (*see Figs.* 208, 224, 225, 226, 227).

If I might be allowed to state in what direction I would like to work had I the knowledge of biochemical processes, and the time and ability to carry them out, I would study the autolytic products of injured epithelial cells, to attempt to determine whether they could or could not, in whole or in part, influence ordered or disordered cell-multiplication.

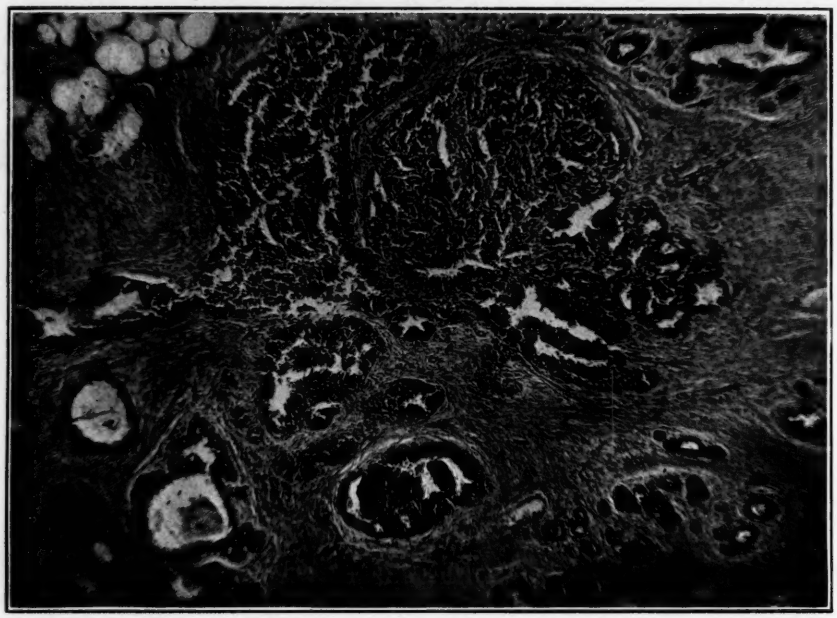

FIG. 228.—Duct on the left periphery of the breast shown in *Fig.* 208. It is one of the foci of primary duct cancer that arose in this breast.

It seems to me an investigation upon which great issues might depend. Many of these cancer-bearing ducts to which I have referred show no signs of a surrounding inflammatory cell fauna. Therefore I would bear in mind the possibility that irritation that was capable of inducing epithelial cells to proliferate might be too slight to induce a surrounding inflammatory affection.

The facts that young workers in tar suffer from warts, middle-aged workers in tar suffer from squamous epithelioma that falls out and cures itself, and that still older workers suffer and die from typical squamous epithelioma, point out that age must be taken into consideration in the investigation.

'Tar-workers' cancer' is an ideal experiment to study, and the late Mr. Harold Barnard's original observations on tar workers,* upon which the above statement is founded, are too important to be left out of consideration.

Again I have to thank Mr. J. E. Barnard for his skill in photographing my sections.

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* *Polyclinic*, 1904, vol. viii.

THE SURGERY OF THE SPLEEN.*

By Sir BERKELEY MOYNIHAN, Leeds.

It was known to the ancients, and their knowledge has been confirmed in all later times, that the spleen is not essential to life. Aristotle wrote: "It is the position of the liver on the right side of the body that is the main cause for the formation of the spleen; the existence of which thus becomes to a certain extent a matter of necessity in all animals, though not of very stringent necessity". Erasistratus took the view that the spleen was wholly devoid of use. Galen spoke of it as an organ "full of mystery". In an old English translation by Holland of the *Natural History* of C. Pliny (23 to 79 A.D.) the following statement is found: "This member hath a proprietie by itself sometimes, to hinder a man's running: whereupon professed runners in the race that be troubled with the splene have a devise to burne and waste it with a hot yron. And no marveile: for why? They say that the splene may be taken out of the body by way of incision, and yet the creature live nevertheless: but if it be man or woman that is thus cut for the splene, he or she looseth their laughter by the means. For sure it is that intemperate laughers have always great splenes".

Shakespeare speaks of both these functions of the spleen:—

> "Such fantastic tricks
> As make the angels weep; who, with our spleens
> Would all themselves laugh mortal."
>
> *Measure for Measure*, II, ii, 121.

And, again, Maria, in *Twelfth Night*, as she ridicules Malvolio before Sir Toby, says:—

> "If you desire the spleen and will laugh yourself into stitches, follow me."
>
> *Twelfth Night*, III, ii, 72.

Of its effect upon the pace of a runner the Bastard speaks in *King John*:—

> "I am scalded with my violent motion
> And spleen of speed to see your Majesty."
>
> *King John*, v, vii, 49.

In ancient literature the statement is made more than once that the giraffe, noted for a turn of high speed, is spleenless—an interesting example, of which evidences are still to be discovered in the literature of to-day, that statements lacking in truth, capable of verification or refutation, but never so tested, are slavishly copied by one author from another. In the middle ages, as Brogsitter has told us, the belief in the inhibitory effect of the spleen upon the pace of runners is found in Murer's *Belagerung von Babylon*:—

> "Ich han mir lon dass milz Schnyden
> Dass ich mag laufen wegt und veer."

It is interesting to note that, if records are to be trusted, the removal of the spleen from a human being preceded the removal, for experimental purposes, from animals. The following account of the first recorded case of splenectomy is given in *The Treasure of Human Life*, by Leonardo Fioravanti, Chapter 8. A translation has been kindly made for me by Mr. L. A. Sheppard, of the British Museum.

Treatment of a woman whose spleen I removed.—This same year (1549) in the aforementioned month of April, I was called to visit a Greek lady who lived near the garden of the

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* The Bradshaw Lecture delivered before the Royal College of Surgeons, London, on Dec. 6, 1920.

Marquis of Terranuova. She was the wife of the Greek Captain Matio, who died afterwards in the year 1551, in the African War. This young woman, twenty-four years of age, had a very great enlargement of the spleen. It grew so large in her body that you could not conceive it larger. It caused both legs to be very badly ulcerated, and the poor woman could hardly live longer.

Having been visited by various doctors, she was told that if she wished to recover it was necessary to remove the spleen ; that it was an easy matter, without danger, and so on. So the poor woman, who had been the most beautiful lady of that town, and a great favourite, pondered whether she wished to die or recover, and began to beg the captain, her husband, to find someone who would remove her spleen. She begged so hard that the poor gentleman began to look for a doctor to perform such an operation, and while he was searching I was recommended to him. He came to see me at my house and took me to his home to see the lady. I saw her and talked to her, and cheered her as best I could. She asked me it I felt capable of removing her spleen. I said 'Yes' readily, although I had never before removed one. But since then, in Naples, I have removed another, as I shall describe when I come to that place.

So I promised to perform the operation, and having promised, every day she urged me to do so. But to tell the truth, although I had promised, I did not want to treat her for fear of making some blunder. But notwithstanding, I sent for a certain old man, of the kingdom of Naples, of a town called Palo. This old man, named Andriano Zaccarello, operated with the knife, removed cataracts and such things, and was much experienced in this profession. The old man soon came to my house, and I said to him, Dear Messer Andriano, a strange thing has come into the head of the wife of Captain Matio, the Greek—she wishes to have her spleen removed. I should like to know from you if it is a thing that could be done without danger ?' 'Yes', answered the old man, 'one can do it, because it is a thing that has been done many times in my life time'. 'Then do you feel capable of undertaking it ?' I asked. He replied that he would do it with me, but not otherwise, so we agreed to do it.

I went to see the lady, and made preparations with her and her husband, and having done so, went to the Justices, to give her up for dead, as is usually done.

And having permission, we went one morning to the lady's house. The good old man took a razor and cut the flesh above the spleen, which being cut, came out of the body. We went on separating it from the reticulum, and took it all out, and sewed up the flesh, leaving only a small opening. I dressed it with mixed oil of hypericum, incense powder, mastic, myrrh, and sarcocolla, and ordered her a drink of boiled water with ordinary honey, comfrey, betony, and holy-thistle, and every day I made her take a dose of theriac.

So I continued to relieve her in such a way that the poor woman in twenty-four days was cured and went to mass at the Madonna dei Miracoli near the Dogana, and was safe and sound. The spleen that was removed weighed 32 ounces. It was taken to the Loggia of the Merchants, and there remained three days, when all the town saw it, and the honour of such an experiment was given to me. Wherefore the people came to me as to an oracle ; and every day I debated with various people and learned many things in my subject, so that beyond the gain and experience I learned yet many secrets, and, to tell the truth, there is no better way of learning than by going about the world, for every day one sees new things and learns various important secrets.

The veracity of this description has been challenged more than once, chiefly because of the discrepancy between the alleged bulk of the tumour and the insignificant weight of the mass removed. Simon, chiefly for this reason, suggests that the tumour was an ovarian cyst from which much fluid had leaked between the time of removal and the time of weighing. If the description is true, it is certain that earlier cases than this had occurred in the practice of Zaccarello. Baillon* very briefly mentions the successful removal of the spleen in the year 1578 by an operator whose name is not given. Rousset described, in 1581, the successful removal by Viard, on two occasions, of a spleen which protruded through a wound on the left side. Two similar cases are recorded in the 17th century.

Observatio CXCV.—Cruger, Daniel. *De exciso liene ex homine, sine noxa. Miscellanea curiosa sive ephemeridum medico-physicarum Germanicium Academiæ naturæ curiosorum.* Decuriæ ii, Annut. Lertini anni M.D.C.LXXXIV. Norinbergræ, 1684, p. 378.

A man named Scultetus, of Henickhagen, was knocked down by a rustic, and severely wounded in the left side by him with a knife. The wound made by the knife caused the prolapse of a large portion of the spleen. The man subsequently vomited, and wallowed in his own blood, and was left without any assistance during the night. In the morning, at the request of the magistrate, Nicolaus Matthias, a surgeon of Colberg, arrived, and found the unhappy man immersed in blood and the swollen spleen protruding from his body. All who were present, with the priest, saw the spleen, and were astonished at seeing so large a viscus protruding from the wound. By the aid of milk and herbs of a nature suitable for fermentation, the surgeon proceeded to tend the wound, and about sundown had the patient transferred to Colberg. On the following day a physician

* *Opera Omnia Med.*, i, 183.

was called into consultation, and the surgeon showed him the swollen and protruding spleen, and inquired of him whether he should excise it. The physician, who said the authorities had taught that no one could live without the spleen, was averse to this being done ; the blood flowing from the organs within the abdomen in large amounts would be without a proper passage for or method of exit. The surgeon, on the contrary, because the spleen was protruding considerably through the wound, said that he could not see that it was possible to replace the spleen in its proper position in the body, and that he considered it would be better that it should be removed. The patient consented to this ; he turned in this critical moment of impending death, and said that he was prepared to suffer everything patiently. The surgeon then ligatured the protruding portion of the spleen with a silk cord and withdrew the entire viscus from the cavity of the body. Next, that portion where it was adherent to the body he constricted with a cord, and on the third day afterwards he resected the whole spleen, and checked the abundant hæmorrhage with styptic powder. By the employment of suitable medicaments he restored the patient to health within the space of three weeks, although there remained in the wound a small swelling resembling a hazel nut, because at that place the vessels were adherent to the divided tissues. To this day the man lives happily with his wife, not deprived of offspring, and carries on his ordinary occupation.

The following is the testimony of an eye witness :—

I declare that I have seen with my eyes the spleen of a young man, age 23, projecting from a wound in the left side ; that the spleen was of the usual size, and that it was detached from all its connections ; I have also felt and touched the spleen with my hands.

That on the third day after the receipt of the wound it was excised by a surgeon summoned from the town, named Nicolaus Matthias. I know, because the same surgeon held a conference with me, and brought the same spleen recently excised. The burgomaster, Edw. Kundenreichen, and the pastor, Herm. Thom Hoppen, were also visited by the surgeon and were shown the spleen. Before it was excised the spleen hung out from the wound ; about the stomach it was torn from all its connections, also from the splenic artery and vein, and it resembled a rigid and gangrenous limb.

The injured man soon recovered from this and other wounds ; and was able to carry on his usual avocations ; and is in good health at the present time ; this I have observed with astonishment in company with those people with whom he is accustomed to mix.

(signed) Joh. Auenius.

Observatio CLXV.—Clarke, D. Timotheus. *De lienis resectione in homine vivo. Ibid.* p. 209. *Miscellanea curiosa medico-physica academiæ naturæ curiosorum, sive ephemeridum medico-physicarum ; Annus IV, V.* Francofurti et Lipsiæ, 1676, p. 208.

A butcher, named William Panier, living in the village of Wayford, near Crookhome, in the County of Somerset, being greatly in debt, and feeling lest he should be arrested, was constrained to go into hiding. The constables were about to capture him, and becoming desperate, and in order to avoid them, he drove his butcher's knife into his abdomen on the left side, thus causing a great wound through which part of the omentum, and of the intestine, and also the spleen, protruded. The constables were horrified, and left the man for dead, as they believed. For three days the wound remained without a suture, but at last a surgeon was summoned. The surgeon replaced the intestines, and cut away part of the omentum, along with the spleen. The man rapidly recovered from the effects of the wound, and for the whole of the following year remained in good health and spirits. He soon afterwards emigrated to New England, where not long ago he was so far living a healthy life. Doubeny Turbervile, M.D., a man worthy of high credit, and a witness of the occurrence, renouned among our fellow-countrymen for his treatment of diseases of the eyes, has collaborated with me in communicating this observation.

The first experiments made upon the spleen were carried out in 1669, by Malpighi, who ligatured the splenic artery and vein in a dog. A subsequent operation showed that the spleen had undergone almost complete atrophy, and that the liver had enlarged. Malpighi's name is, of course, for ever associated with the lymphoid follicles of the spleen. In 1676 Clarke (*vide supra*) performed the first experimental splenectomy in a dog. The animal recovered, and the only subsequent change noticed in it was that it became much fatter. Morgagni describes a successful case of splenectomy in the dog, performed by Zambeccari, at Florence, in 1680. It is evident that he performed this operation himself quite frequently after this date, for he observes that, after studying the matter for five years, he found that the dogs underwent no special change in consequence of such an operation ; the dogs did not grow fatter, had no loss of fertility, and no change in their manners or disposition was noted.

In the nineteenth century experimental observations increased rapidly in number. In 1828 Schultz records that he had removed the spleen from 24 animals, 23 of whom survived the operation. After the operation the fertility of animals was reduced, there was a greater inclination and ability to run far, and a diminished secretion of bile. Czermak

also observed the lessened fertility of animals, and remarked upon the enlargement of the lymph-glands in the mesentery. In the year 1841 A. Bardeleben published the results of his experiments, which were directed towards the discovery of the functions of the spleen. They were the first well-considered and fully-recorded operations to be performed, and they have become classical. For the first time they showed with complete proof that animals could live and thrive after the removal of the spleen, and that certain changes, possibly compensatory in character, followed upon the loss of this organ. The changes noted were in the blood and the lymphatic glands. Vulpius, who followed in 1894, summarized his observations as follows :—

1. Extirpation of the spleen produces a transitory decrease in the number of red, and an increase in the number of white, blood-corpuscles.

2. The thyroid gland cannot vicariously assume the function of the spleen.

3. The lymphatic glands and the bone-marrow show an increased blood-forming activity after removal of the spleen.

4. The regeneration of the blood, after the loss of blood, is probably less rapid in individuals in whom splenectomy has been performed.

A great many observers confirmed these observations subsequently.

That the spleen is not essential to life is also shown by the fact that it is occasionally absent. Aristotle wrote : " The spleen is not invariably present ; and in those animals that have it, it is only present of necessity in the same sense as the excretions of the belly and of the bladder are necessary, that is, of being an inevitable concomitant ". Rokitansky and Ziegler in the middle of the nineteenth century asserted that the spleen was not always present, but neither gave any specific instance of its absence. At the close of the century Hodenpyl* found records of nine cases of alleged absence of this organ, and related a tenth case observed by himself. Two of the cases occurred in infants six weeks and one hour old respectively ; the remaining eight instances were in adults, the oldest being a woman, age 57, who had no unusual symptoms during her lifetime. The records of at least three of these are disputable. Indubitable cases of congenital absence of the spleen are related by Sternberg, Kohllass, and Riches.†

By the middle of the last century it was, therefore, conclusively established by experience which was beyond cavil that the spleen was an organ not necessarily present in normal individuals, that its removal, when successful, did not seriously impair the chances of life and of good health, and that after its removal certain changes assumed to be of a compensatory character followed in due course. The way was then prepared for the question of the deliberate removal of the spleen from man in conditions in which it was enlarged by disease. The first instance of such an operation is related by Quittenbaum, of Rostock, in 1826 (the father of ovariotomy in Germany), who, after a series of experiments in which the spleen was successfully removed from cats and dogs, undertook the removal of the organ from a human being. The patient, it is interesting to note in connection with recent developments of the surgery of the organ, was a woman suffering from cirrhosis of the liver and ascites. It was " the patient's urgent entreaty rather than the surgeon's judgement " which led to the performance of the operation in a woman so ill. She survived the operation only six hours.

Controversy in surgery may often tend to be coarsening, but we cannot gainsay its occasional advantages. It serves to challenge opinions which might too readily be accepted, to oppose reason to authority, to destroy prejudices, or to support a truth which otherwise might long pass unnoticed. In the year 1855 it raged round the question as to whether the operation of splenectomy could be justified. The story is told by Simon.‡ Küchler, of Darmstadt, had removed the spleen from a patient, age 36, who fourteen years before had suffered for nine months from malarial fever. The spleen on palpation was estimated to have a length of 13 inches and a breadth of 7 inches. Death four hours after the beginning of the operation was due to hæmorrhage from a branch of the splenic artery,

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* *Med. Record*, 1898, ii, 695. † *Jour. of Ment. Sci.*, 1914, lx, 630.

‡ *Die Extirpation der Milz* (Giessen, 1857).

which had either escaped ligature at the time of operation or from which the ligature had subsequently slipped. Post-mortem examination showed cirrhosis of the liver, and about 250 c.c. of serous fluid was present in the peritoneal cavity, with 625 grms. of coagulated blood. The matter was taken up by the Surgical Association of Hesse, represented by Simon, and a long and bitter controversy resulted. Simon's greater experience and authority seemed to prevail, and he decided that the operation was only justified in cases where a wound had been inflicted which threatened otherwise to be fatal. Küchler, in his defence, published a pamphlet, entitled, *Extirpation of a Tumour of the Spleen. Light upon the Question of Extirpation of the Spleen in Man, its Practicability and its Justification.** In this publication he gives details of the operation he performed, and draws a parallel with six previously recorded cases of splenectomy in human beings. In three of these cases the operation had been performed for hypertrophy or abscess, and in three for prolapse of the organ through an abdominal wound. Küchler sent this pamphlet to the Medical Faculty of the University of Dorpat with the request that they would communicate to him their opinion of the operation of splenectomy. Adelmann was appointed by the Faculty to draw up their report. He searched the earlier literature for examples of this operation, and formed an opinion favourable to Küchler's view. His report was published in *Deutsche Klinik* for 1856. Adelmann also inspired a thesis by Johannes Braun, of Warsaw, *Lienis in homine extirpatio*, published in 1857, in which the literal text of the earliest recorded cases was given. In this year, 1857, there appeared also the paper of Gustav Simon, which has been a storehouse of information upon the history of the operation for all subsequent writers. In this publication, the author, possessed of an extensive acquaintance with the literature dealing with the physiology, pathology, and surgery of the spleen, but deeply prejudiced by his controversy with Küchler, expressed the opinion that removal of the diseased spleen under any circumstances was an unwarrantable operation. Küchler's reply was to point out that "the conclusions of Simon are in themselves unreliable and illogical, and throw doubt upon incontrovertible facts". Adelmann† gives a full account of this discussion, and decides: "From such expressions we may conclude that there was personal friction between the two Darmstadt surgeons. In September, 1858, when I made the personal acquaintance of both of these colleagues in Karlsruhe, I endeavoured, unfortunately without success, to bring about a reconciliation between them".

The first splenectomy deliberately performed in England (the fifth in the history of the operation) for an enlargement of the organ, is related by Spencer Wells.‡ The patient was a married woman, 34 years of age, who was "evidently dying from a large spleen", and who had no other disease. The following is the account of the operation given by Spencer Wells:—

"I made an incision along the outer border of the left rectus abdominis which extended five inches above and two below the umbilicus. Two arteries were tied before the peritoneum was opened. In opening the peritoneum a rather large artery was cut across in a piece of omentum, which was loosely adherent between the surface of the spleen and the abdominal wall. The vessel was tied. The adhering portion of omentum was separated, and by putting in my hand and turning the lower edge of the spleen first through the opening, the whole of it was easily removed. The intestines were prevented from escaping by Dr. Wright, who kept the edges of the opening carefully together behind the spleen, which was held only by the vessels and the gastrosplenic omentum. I was beginning to twist the spleen round to bring the vessels into a sort of cord preparatory to applying a ligature, when the splenic vein, which was as large as a small finger, gave way, and blood ran freely from the spleen; but none was allowed to enter the abdomen, and I at once enclosed the vessels in a large clamp, and cut away the spleen. Before tying the vessels temporarily secured by the clamp, I passed eight silk sutures to keep the edges of the incision well together. The peritoneum was thus protected and the viscera retained while I was dealing with the vessels. These were tied in two bundles above the clamp, which was then loosened, and two arteries and a vein were also separately tied before it was finally removed. On taking it off, I found that a part of one end of the pancreas, as large as the end of a thumb, had been bruised by it. All the

* Darmstadt, 1855, Dietatall. † *Arch. f. klin. Chir.*, 1887, xxxvi, 442.
‡ *Med. Times and Gaz.*, 1866, i, 2.

ligatures, except those on vessels in the abdominal wall, were cut off close and returned with the included tissues. The sutures were then tied, and the abdomen was well supported by plaster, pads of lint, and a bandage."

The patient died of septicæmia 158 hours after the operation.

By this time the position of Spencer Wells in the surgical world was such that his authority was an absolute warrant for the performance of any abdominal operation. His sagacity, integrity, prudence combined with intrepidity, and technical skill were such as to command the respect of all men. And it was accordingly not very long before other operations involving the removal of the enlarged spleen were attempted. T. Bryant, of Guy's Hospital, performed the operation twice, in 1866 and in 1867, in cases of leucocythæmia. Both patients died rapidly from hæmorrhage, one fifteen minutes, the other one and a half hours, after operation. Koeberle, of Strasburg, performed a similar operation for a like condition in 1867; the patient died 'soon after', of hæmorrhage. Spencer Wells in 1873 and again in 1876 removed the spleen for this disease, and both patients died, one of peritonitis, one of hæmorrhage.

In the year 1882 H. Collier* reviewed the position of the operation of splenectomy, and gave a brief account of all the cases, 29 in number, submitted to operation up to that date. Of 13 operations performed for various conditions, 'wandering spleen', hydatid cysts, simple enlargement, 'ague cake', 8 were successful, the patients making perfect recoveries. Of 16 cases in which leucocythæmia was present, there was no instance in which the patient recovered even from the primary effects of the operation. Bryant's comment upon his two cases was as follows: "We have learnt two things from the cases related. Firstly, that enlargement of the spleen in leucocythæmia appears to be only a part of a general disease affecting the glandular system as a whole; and, secondly, that in splenotomy for such a disease there is a predisposition to hæmorrhage with which surgery is incompetent to deal. It can neither be foreseen by any amount of care, nor coped with by any amount of skill. Under these circumstances there is no shirking the conclusion that the operation is physiologically unsound and surgically unsafe, and, for leucocythæmia should not be performed".

From this date up to the last few years the operation was reserved for cases of injury, for spleens with a rotation of the pedicle, for cysts of the spleen, or for cases of enlargement of the organ due to causes which were not always discoverable. In the year 1898 Vanverts, in a Paris thesis, collected the records of 274 cases of splenectomy with 170 recoveries.

In the last few years splenectomy has been performed in certain of the anæmias associated with splenomegaly. The technique of the operation has been greatly improved, and the mortality in all classes of cases very considerably reduced.

Dr. W. J. Mayo has most kindly given me the records of the Mayo clinic up to September 20, 1920. They show better than any other record the modern position of the operation of splenectomy.

Splenectomies for Splenic Anæmia.

Total number of cases to Sept. 20, 1920	73
Total number of hospital deaths	9 = 12·3 per cent.

Out of a total of twenty-seven cases operated on 5 years or more ago, seventeen patients lived over 5 years; of these patients, sixteen are still living.

The results in splenic anæmia, generally speaking, have been good, but the operation is more difficult than in other conditions, and the mortality is considerable.

Splenectomies for Pernicious Anæmia.

Total number of cases to Sept. 20, 1920	53
Total number of hospital deaths	3 = 5·6 per cent.

Five patients living 4 to 5 years after operation. Eleven patients living 3 to 4 years after operation.

* *Lancet*, 1882, i, 219.

The fact that 22 per cent of patients have lived two and one-half times as long as the average, shows that in early cases of pernicious anæmia the operation is at least justifiable.

SPLENECTOMIES FOR MYELOGENOUS LEUKÆMIA.

Total number of cases to Sept. 20, 1920 26
Total number of hospital deaths .. .. 1 = 3·8 per cent.

One patient died 5 years and 4½ months after operation. Seven patients living 3 to 4 years after operation. Six of these are still living.

The results are poor in myelogenous leukæmia, but five patients are in good condition and two in fair condition after periods of time beyond the life-expectancy of these cases. The patients are at least relieved of the weight of the spleen, and in two instances supposed to be early cases of myelogenous leukæmia, not counted in this series, the patients have been cured, or at least they have lived a number of years following operation. The operation is not difficult after radium treatment, and in selected cases should be further considered.

SPLENECTOMIES FOR HÆMOLYTIC ICTERUS.

Total number of cases to Sept. 20, 1920 32
Total number of hospital deaths .. .. 1 = 3·1 per cent.

One patient living over 9 years after operation.

The results in hæmolytic icterus have been excellent. Splenectomy is a real cure in a high percentage of cases.

SPLENECTOMIES FOR SEPTIC SPLENOMEGALIAS.

Total number of cases to Sept. 20, 1920 10
Total number of hospital deaths .. .. 2 = 20 per cent.

Splenectomy is undoubtedly indicated in some of these cases.

DIAGNOSIS	NO. OF CASES	HOSPITAL DEATHS
Portal cirrhosis	9	4
Biliary cirrhosis	6	1
Lymphoma	3	0
Luetic splenomegalias	6	1
Lymphosarcoma	2	0
Gaucher's disease	4	1
Tuberculosis	4	0
Wandering spleen	2	0
Splenomegaly with eosinophilia ..	1	0
Splenomegaly with neutrophilia	1	1
Miscellaneous, questionable ..	11	2
	49	10

Thus the total number of cases is 243, with 26 hospital deaths.

ON THE FUNCTIONS OF THE SPLEEN.

(*See Fig.* 229.)

The cœliac axis, the first visceral branch of the abdominal aorta, supplies those organs, the stomach, the liver, and the pancreas, which are especially concerned in disorders of the spleen. The largest of its three branches is the splenic artery. Each branch of this artery within the spleen supplies a different compartment of the organ, and its main subdivisions each end rather abruptly in a small pencil of arterioles near the periphery of the organ. Close to its termination each of the subdivisions of the artery is enveloped by a small mass of lymphoid tissue, the so-called Malpighian body, in which the manufacture

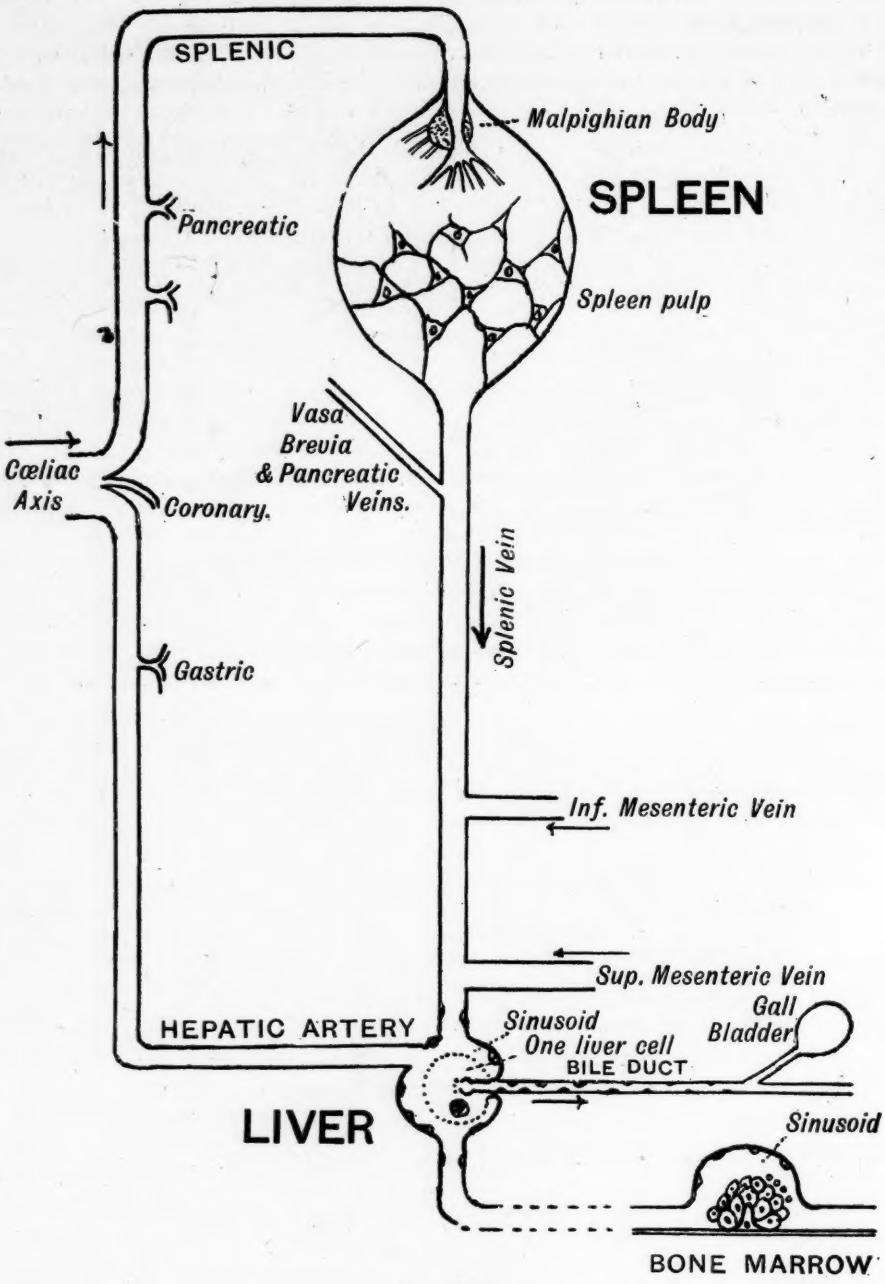

FIG. 229.

TO SHOW THE RELATIONS BETWEEN LIVER, SPLEEN AND BONE MARROW.

of lymphocytes takes place. This small mass of tissue is supplied by a coil of minute arteries springing at right angles from the main course of the vessel. In this way the large germinal cells of the follicle are provided with arterial blood, and give rise to successive generations of lymphoid cells until a colony of ordinary lymphocytes results. These lose their attachments and drift outwards into the surrounding splenic tissue.

The pencil of arterioles finally gives place to the spongework of which the spleen essentially consists. Taken broadly, it may be said that the spleen consists of a meshwork of delicate fibres which serve to retard the flow of the blood, and to allow its constituents to come into thorough contact with the specific cellular elements which are attached to the network in large numbers. These cells are similar to the cells lining the capillaries of all parts of the body. In the capillaries they are orderly in arrangement and definite in position, and they appear as the lining of complete tubes. In the spleen-tissue or spleen-pulp they are larger, they are disorderly, and they cease to form definite channels. Since it is admitted that the endothelial cells of capillaries are capable of phagocytosis, it is not difficult to see a close resemblance between them and the so-called reticular cells of the spleen. These latter cells, it is true, exhibit a certain sort of arrangement, since the blood runs more vigorously in some directions than in others, allowing a distinction to be made, on close examination, between blood-channels and pulp-cords. The latter are perhaps twice as broad as the more open channels which separate them, but cannot be regarded as solid tissue. The blood flows more slowly through them than through the adjoining channels. When, however, a pathologieal change occurs, it is not infrequent to find that the channels become relatively more distinct, and the pulp-cords more indefinite in character.

Various authors describe a number of types of cell as entering into the cellular composition of the pulp; but if we exclude the purely supporting cells (which provide the reticulum proper), it is possible to group all the others in one category—that of *modified endothelial cells*. There is an abundant literature dealing with the question of the specific pulp-cells of the spleen, from which it is possible to draw the following simple picture: that these modified endothelial cells which cling to the reticular meshwork are occupied in different ways at different times. Sometimes they remain stationary and gather up passing particles suitable as food; at other times they separate from the meshwork and wander among it—likewise for the purpose of engulfing solid particles (notably effete red blood-cells); at other times still they undergo proliferation. It is very probable that they remain stationary for this purpose, and produce daughter cells and granddaughter cells which adhere to one another for a time, but ultimately separate (either in the daughter or in the granddaughter stage), and remain in the spleen as, apparently, a special type of cell, or else pass away in the blood of the splenic veins.

It is especially important to notice that the blood in this meshwork is venous, since it is asserted that the processes of multiplication of the pulp-cells, and the varieties of cell which result therefrom, are particularly modified by the carbon-dioxide atmosphere in which they reside (Loele). The purely lymphatic cells of the Malpighian bodies, which lie in a medium richer in oxygen, give rise to a very different progeny.

The blood as it leaves the spleen carries with it some of these pulp-cells, or their descendants, but leaves behind it a certain number of red corpuscles and other solid particles. As it emerges by the splenic vein it immediately meets two streams of venous blood, one coming from the cardiac end of the stomach, and the other from the tail of the pancreas, facts no doubt of great physiological significance. Nearer the liver it meets successively a stream of blood from the descending colon, and the great mass of blood returning from the alimentary tract bearing with it the products of digestion, such as sugar and the amino-acids of protein, etc.

It is probable that a mingling of these various portions of blood occurs in the wide portal vein, but the degree to which this takes place is uncertain. There is evidence to show that, like the Rhone and the Arve, the two streams long remain separate parts of a great common stream. And the view is taken by many authorities, upon what appears reasonable evidence, that the larger part of the splenic blood goes to the left lobe of the

liver. Tested experimentally by injecting in the cadaver a continuous stream of red fluid through the splenic vein and a continuous stream of blue fluid by the superior mesenteric vein, the mingling of the two streams appears to be complete when the issue from the severed portal vein is watched. The stream of blood in the portal vein finally comes in contact with the liver tissue, whose cells exert upon it their metabolic activity. If we regard the matter as concerning a single liver-cell, the following events occur. The blood flowing from the free surface of the liver-cell becomes mixed with a small stream of blood derived from the hepatic artery, the next largest branch of the cœliac axis. Oxygenated and venous blood thus come in contact with the free surface of the liver-cell, which, if represented in a diagram, would appear to be protruding into a dilated vascular channel —a 'sinusoid'. All other surfaces of the latter are lined with endothelium, the cells being of conspicuous size, endowed with phagocytic powers, and known as Kupffer's star-cells. The liver-cells are now regarded as containing a network of intracellular canaliculi emptying into a small ampulla from which a minute duct issues. This, joining with other ducts similarly arising, forms at last a tiny bile-duct visible to the naked eye. Since the liver-cell forms bile out of the blood flowing in the portal vein, the ingredients of the bile must enter the liver-cell and appear within the minute canaliculi. If these substances enter, so also may other substances conveyed by the blood, and, by penetrating the liver-cell, finally obtain access to the bile-duct beyond. It is a fact that the liver-cell takes up other substances, which never pass into the bile-ducts, and stores them in the protoplasm without any risk of their emerging by that system of vessels. It is also known that the liver-cell is capable of discharging ferments into the blood-space around it, a fact which makes it reasonable to suppose that many changes can and do take place in the blood without the substances concerned entering directly into the liver-cell at any time.

In the spleen-pulp, the endothelial cells share one of the properties of all cells—that of making ferments. The blood may undergo definite change in chemical composition as it lingers among the meshes of the spleen. Then, before it enters the liver, it has become mixed with products from the stomach, and with ferment from the tail of the pancreas, where the islands of Langerhans are three times as numerous as elsewhere. Obviously some change must take place if and when the two become admixed ; and, indeed, the observations of Herzen and Bellamy* on the action of the splenic and gastric blood strongly indicate the existence of such changes. Finally, attention may again be drawn to the fact that this blood undergoes a still further change in composition by receiving the blood from the large intestine, and from the small intestine with its products of digestion, which necessarily include ferment substances absorbed with food.

The spleen has long been thought of as a blood-forming organ ; and during fœtal life it appears certainly to be concerned in the formation of red cells ; in consequence, dominant attention has been directed to the fact of its enlargement in many so-called diseases of the blood. It is therefore desirable to add to the picture so far drawn, details in reference to the chief of the blood-forming organs—namely, the bone-marrow. Arterial blood, entering the nutrient arteries, passes through the minute capillaries of the marrow of the long bones and enters into dilated cavities recalling those into which the liver-cells project. These also are called 'sinusoids'. The endothelial cells projecting into them are modified into large sustentacular cells, from which sprout the various cells described as concerned in the formation of red and white cells respectively. It has been said that the red cells form on such buds where they are bathed in arterial blood, while the white cells appear in those portions where the blood has become richer in carbon dioxide. As in the spleen-pulp, the daughter and granddaughter generations remain adherent to the sustentacular cell until they are ripe, after which they become loose and float away in the blood-stream.

The ground having been cleared by these very brief anatomical and physiological considerations, it now becomes possible to review the large amount of work which has

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* *Lancet*, 1900, ii, 371.

been done by many investigators in reference to the functions of the spleen, and perhaps to elucidate some of the difficulties of contradictory observations.

The lines of inquiry and research have been broadly as follows: (1) Study of the effect of splenectomy in man and animals upon the general health, upon the blood, and ultimately upon the various tissues; (2) Study of the action of extracts of the spleen, when administered in various ways; (3) Study of the action of splenic extracts on various phases of artificial digestion in the laboratory; (4) Biochemical investigations upon the spleen, upon the metabolic activities of the body, and upon the several secretions; (5) Microscopical studies of the spleen and other organs in case of diseases of the spleen, as well as in normal and splenectomized animals subjected to the action of various drugs; (6) Consideration of clinical cases in which the spleen was known to be diseased, any special phenomena being carefully observed in order to decide to what extent the spleen was to be held responsible for them. Of all these methods, the study of splenectomized animals has been most widely followed.

Even when allowance is made for the ultimate differences which are shown by the cases of splenectomy in man, due to the varying reasons for the performance of the operation, there remain certain *changes in the blood* which agree with those found in splenectomized animals. There is a temporary anæmia, gradually subsiding in approximately two months' time, and there is an increase in leucocytes, whose numbers return to the normal very slowly. An increase of the lymphocytes persists for about a year, and gives place to a moderate eosinophilia, which increases up to about 8 per cent during the third year. Apart from these laboratory discoveries there is no particular change to be noticed in the condition or in the health of the patient. It has been asserted that a certain degree of asthenia persists, and that the patient shows an increased liability to become infected with epidemic diseases, such as influenza. But in these respects there is no uniformity of evidence, doubtless owing to lack of knowledge of the normal resisting power of the patients, to differences of age, to the various diseases for which the operation may have been performed, and to the condition of health in other respects. When the extirpation has been for trauma, the general health of the patient may not have been previously impaired.

After the experimental removal of the organ from animals, certain additional observations have been made. The red cells have been found to become more resistant to hypotonic saline solutions, and the administration of drugs capable of causing hæmolysis has been found to cause jaundice less easily than before. Study of the animals after death has shown proliferation of the endothelial cells in the lymph-glands and in the liver, and a reddening of the bone-marrow has been disclosed.

Briefly stated, these are all the *salient* facts relative to the effects of splenectomy. They are meaningless unless the matter is carried further in order to force answers to certain definite questions which may now be asked.

1. *How much of the effect of splenectomy is due to the mere operation?* Pearce and his co-workers,* whose work is the most recent, and is distinguished throughout by great care and painstaking analysis, incline to attribute much to the operation. They point out that a certain amount of blood is lost with the spleen, and that the appearance of increased resistance of the red cells, and even of their susceptibility to hæmolytic drugs, may be related to the consecutive anæmia, or to the processes engaged in the repair of the anæmia. Banti has insisted that any such explanation is unsatisfactory, and asserts that the increased resistance persists long after the anæmia has passed away; and he further points out that in an animal rendered anæmic by appropriate drugs this change in the resistance of red cells does not occur.

2. *Does the spleen destroy red cells?* There is a general agreement that phagocytosis does go on in the spleen. The agents which carry on this work are the same kind of large mononuclear cells which are found in the sinuses of the lymph-glands. It has been found

**The Spleen and Anæmia*, Philadelphia, 1919.

that these cells are very much increased in numbers in the lymph-glands when drugs acting on the red cells are administered to a splenectomized animal. This suggests that these cells are carrying out vicariously the functions previously performed by the spleen—in other words, the spleen normally destroys red cells. Then, too, the occurrence in the spleen of phagocytes containing red cells in severe anæmias in man, can hardly have any other meaning than that the organ in these conditions fulfils that purpose.

3. *Does the spleen make a substance which weakens the red cells prior to their being engulfed by the phagocytes?* This action has been called 'the hæmocatatonistic function' (Bottazzi), and belief in its existence was based on the observation that the resistance of the red cells begins to increase at once after splenectomy, rising to a certain maximum, at which level it is maintained. But when it was found by other workers, including Pearce, that the same result will occur in the presence of the spleen, by treating an animal with a hæmolytic immune serum, it became evident that the problem is not as simple as Bottazzi assumed. It receives its true answer when the import of the following further questions is understood.

4. *Does the spleen pass on the blood-pigment for conversion into bile-pigment?* Removal of the spleen does not lead to absence of bile-formation, nor to the accumulation of blood-pigment in the blood. The explanation of these observations may be found in the fact that red cells may be taken up by phagocytes anywhere in the body and carried round to the liver. Material for the manufacture of bile-pigment is therefore still available, Pearce, evidently believing, I think, that the blood-pigment is *free* in the splenic blood, has endeavoured to discover what quantity of hæmoglobin must accumulate before it will overflow into the kidney or appear as bile in the urine. There appears to be a definite limit beyond which the colouring matter fails to be dealt with by the liver; and there is a limit to the amount of bile which can flow out of the liver-cell. If so much hæmoglobin is converted into bile-pigment that it cannot leave the bile-channels quickly enough, the excess of bile-pigment accumulates in the blood and jaundice appears. The amount of bile-pigment formed after splenectomy is at first approximately only one-half of that which is formed prior to the operation, and, as Martinotti and Barbacci have shown, this delay accounts for many of the phenomena arising in the course of experimental work upon hæmolytic poisons, and upon the short-circuiting of the splenic vein. All this work is based on the belief that hæmolysis in the body must be the same as hæmolysis in a test-tube, namely, a process of liberation of free hæmoglobin into the surrounding medium (that is, the blood-serum). But the splenic blood cannot be proved to contain free hæmoglobin, and the microscope shows that the red cells are not dissolved in the stream, but are consumed by phagocytic cells—facts of the greatest significance, which have been ignored or too little considered in this line of inquiry.

5. Similarly with reference to the question, *Does the spleen hæmolyse red cells by means of a ferment action?* Expressed in a more technical form, this means, Does the spleen manufacture a 'hæmolysin'? The literature on this point is very extensive, all of it showing how general is the belief that 'hæmolysis' in the body is comparable to a test-tube phenomenon. Yet all observers—Pearce included—have failed to find proof of this ferment action, which was first suggested as possible by Nolf. That the dissolution of red cells within the bodies of phagocytes takes place by an intracellular ferment action is obvious, but it is not in this sense that the question has been raised.

6. A further question often asked, as to *whether the spleen contributes an immune substance*, veils the same belief. The researches of immunology seek to establish the existence of chemical substances circulating as such in the blood-stream. Consequently, viewing these substances as secretions from cells, it is supposed that some of them are formed by the splenic cells, and would be likely to appear in more concentrated form in the splenic juice or in the blood of the splenic vein. In order to stimulate the cells of the spleen to greater activity, various substances have been used or devices adopted to bring about a greater destruction of the red corpuscles, in the hope that the spleen may be induced to secrete more of this immune substance. This accounts for the experiments devised to show the presence and purpose and mode of action of fatty acids and lipoids.

These substances dissolve the red corpuscles. Is it that the spleen prepares such reagents, or that the spleen needs the co-operation of the liver, since the liver is an acknowledged source of both these substances? Eppinger found that the total fats and cholesterin of the blood are increased after splenectomy, and King confirmed his work; but Pearce failed to substantiate it. Anitschkow, taking another side of the problem, sought to show that if the spleen makes a substance for the express purpose of dissolving the red cells, removal of the spleen should diminish the tendency to jaundice. As a matter of fact this does happen if the splenic vein is diverted into the inferior vena cava without removal of the spleen, and is, I think, to be explained by the longer route traversed by the splenic blood, which gives the liver more time to deal with the liberated blood-pigment, seeing that in the new arrangement this becomes distributed over the whole body, instead of being contained only in the portal vein.

Another argument in favour of there being such a function of the spleen is afforded by the fact that exposure of the spleen to *x* rays results in a diminished output of hæmolysin in the experiments on dogs (Hektoen). There are great difficulties in interpreting the experiments relative to this part of the subject, since the bone-marrow also must inevitably be influenced by the substances used to produce hæmolysis.

The whole subject assumes an entirely different aspect when it is discussed from the cellular side, as Sajous has fully done in his work on *Internal Secretions*. Hæmolysis in a normal animal is carried out by cells within cells; immunity-reactions are secured by the same means. These views are fully supported by the results of all the experiments to which reference has been made.

7. *Does the spleen secrete a substance capable of acting on the bone-marrow?* Danilewsky was the first to assert that this was the case, and others corroborate his view. The rapid anæmia after splenectomy, out of proportion to the loss of blood, suggests that some such substance has temporarily ceased to be formed. In one of Pearce's experiments a splenic extract administered to a dog dying from anæmia after splenectomy, saved its life. A single dose of splenic extract given intraperitoneally will induce a rise in the red cells and hæmoglobin content, in dogs who are not dangerously anæmic. The effect, it is interesting to note, is not produced when the splenic tissue is given by the mouth. Another argument in favour of this view, fortified by Pearce, is that regeneration of blood takes place much more slowly than usual when a splenectomized dog has been bled, or rendered anæmic in some other way.

As regards the part of the bone-marrow concerned with the formation of white cells, it has been suggested that there is normally a restraint of its activity through some substance secreted by the spleen. Increased activity of the spleen leads to increased formation of 'leucosplenins', and therefore, consecutively, to a diminution in the number of white cells in the blood. After splenectomy, there is leucocytosis due to the removal of this restraint. Undue restraint occurs, as Schmincke points out, in typhoid, syphilis, malaria, Banti's disease, Gaucher's disease, kala-azar, and Hanot's cirrhosis. When *x* rays are applied to the spleen, they stimulate the splenic cells, cause them to form more leucosplenins, and thus indirectly interfere with the action of the bone-marrow.

Pearce has decided that the relation between the spleen and bone-marrow is rather a matter of the changes which take place in the storage and utilization of the iron of the body than a specific hormone action. Bone-marrow becomes red after splenectomy because it begins to take on the function of storing iron. It is certain that animals suffer largely from loss of iron after this operation, and it is evident that red cells cannot be produced in the absence of iron. Hence the anæmia may have a perfectly simple explanation, making it unnecessary to introduce the notion of special ferment substances into a discussion of the pathology of this subject.

8. A final question: *Is the spleen concerned with the activation of digestive ferments?* Tarulli and Pascucci compared the digestive power of the gastric juice before, and some days or weeks after, extirpation of the spleen in dogs. They also studied the effect of administering watery infusions of 'engorged' spleens (that is, spleens removed from dogs in full digestion), observing at the same time whether the animals lost weight or not. The

result of their experiments is to show that the digestive power is constantly weakened after loss of the spleen during a period of two or three months. The use of a congested spleen-infusion eight hours before the meal restored the digestive power. Infusion of spleen removed in the intervals following active digestion failed to replace the loss of activity of the gastric juice of such dogs. The authors therefore conclude that the spleen provides a substance which causes the gastric glands to produce more pepsin. Hedin and Rowland, however, in 1901, found similar results with extracts of other organs.

The conspicuous feature of all this work—and the quantity of it is very considerable—is the attempt to study the organ almost entirely as a separate entity working in isolation. In future the most eager attention must be given to tracing up, and laying bare, every possible connection it may possess with other organs. The analogy with the work of the surgeon is interesting. In our earlier experience we were concerned with the clinical recognition and the operative treatment of diseases of one organ—the stomach, the duodenum, the gall-bladder, the intestine, or the appendix. We now realize that the diseases in these several organs are secondary, and that some common underlying cause for many of them may be present. Any operation upon one of these organs now involves not merely the examination of that one, but also the scrutiny, and possibly a further operation upon, any one or more of the others. Future experimental work must consider the spleen not as an organ whose functions are confined to its own activities, but as a member of a group of organs each concerned with, and influenced by, the activities of the others. And clinical work must regard the problems of its disease in the same manner. Microscopical examination of the organ, showing as it does exactly what are the tools with which the spleen works, or the tools that go to make up the organ itself, demonstrates very clearly that we have to deal with cell-structures which other blood-forming organs also possess and use; indeed, the capillaries of many parts of the body in general show similar structures.

Intimate connections with the spleen can be found in four important systems of the body: (1) *The hæmopoietic system;* (2) *The reticulo-endothelial system;* (3) *The digestive system;* (4) *The sympathico-endocrine system.* Each of these systems has a depôt, so to speak, in the spleen; but this organ also contains within itself a histological system into which the other four merge. Although the spleen constitutes a link in each one of these systems, they are all able to dispense with its service; and although the presence of the spleen is not by any means a matter of indifference to any of them, yet they are not permanently or irreparably affected by its loss.

1. **The Spleen as a Member of the Hæmopoietic System.**—The part played by the spleen in the formation of red blood-cells and neutrophile leucocytes in embryonic life is everywhere admitted. In adult life the connection is usually only demonstrable under the influence of infections and in the various forms of splenic enlargement, and rarely is there a reversion to the capacity of forming red cells. Leukæmia affords an instance of post-natal resumption of white-cell formation, though the process is, of course, enormously exaggerated. The mechanism of the change is the same in the infections as in leukæmia. The cells of the spleen-pulp become transformed into parent cells tending to give rise to neutrophile leucocytes as they originally did in the embryo. And the process is now the same as in ordinary bone-marrow, where endothelial cells, specially endowed, still give rise to these leucocytes.

A connection between the spleen and the bone-marrow has already been spoken of as dependent upon a hormone, elaborated by the spleen and expended in stimulating the bone-marrow; a hypothesis which explains certain facts. But, as has been suggested, the same facts can be explained more simply. The destruction of red cells by the spleen enables this organ to liberate effete iron in a form capable of reconstruction into a complex albuminous substance when it leaves the spleen to enter the liver. In this synthetic process the first step is checked by excision of the spleen; and sufficient iron to make the usual hourly complement of red cells is not then available for the bone-marrow. I think Krumbharr expresses this view when he asserts that the spleen furnishes a substance which is activated by the liver. But neither the substance, nor the activated products, are new

and additional; they are pre-existing substances, temporarily parted, and re-united in rejuvenated form on the distal side of the liver.

In the same way, the theory of Horbaczewski that the spleen-pulp secretes a substance normally restraining white-cell formation may be looked on as too superficial, and experimental evidence to support it is not at all conclusive.

2. The Spleen as part of the Reticulo-Endothelial System.—We owe the conception of this system of the body to Aschoff. It has evoked numerous investigations, and as time goes on it is regarded more and more as important, once again raising to supreme interest a sphere of action in the body the consideration of which has been neglected for nearly forty years.

Wherever the tissue surrounding capillaries is loose, the endothelial cells are found to be closely connected with the surrounding reticular cells. The endothelium and the perithelium form parts of a meshwork, and this again becomes connected with the reticular meshwork familiar in connective tissue. The spleen-pulp furnishes a very good picture of this arrangement, for the meshwork is made of reticular cells which can be traced continuously into the network formed of the fraying edges of the blood-vascular channels where they open out or, on the venous side, close up into the spongework of the organ.

In the liver, certain large cells, the star-cells of Kupffer, excited much speculation for many years. They are essentially phagocytic in function, and are really to be regarded as endothelial in nature. After splenectomy they undergo proliferation. In hæmolytic diseases they become filled with iron pigment. The endothelial cells of the lymphatic glands are also phagocytic, and undergo proliferation after splenectomy. They exactly resemble the corresponding cells in the spleen. Similarly, the bone-marrow provides a meshwork of cells exactly comparable to the cells of the splenic pulp, though characteristically active in their own special direction.

A complete histological system can therefore be easily traced in many important parts of the body. It is traceable, if less easily, as a generally distributing form of tissue, not specially noticed hitherto, yet performing one of the most important parts in the physiology of the body. It is rightly attracting increasing attention at the present time.

The nature of the spleen-pulp cell; the changes it may undergo in different diseases and under different forms of stimulus; its relations to the connective tissue of the organs; its chemical characters, and the powers of taking up certain 'vital' and other dyes—have all been carefully worked out during recent years, and give a satisfactory insight into the minute processes which collectively constitute the functions of the spleen. It is the phagocytic proclivities of these cells which account for the harbouring of micro-organisms in the spleen-pulp; and it is the great vitality of these organisms, even after ingestion, which accounts for the latency of many infections. The malarial parasites notoriously find a home here, from which they only emerge under provocation. The same is true of the pallid spirochæte. Whatever truth there may be in the view that cirrhosis of the liver is due to bacterial infection finds its explanation in the two phenomena of phagocytosis together with persistent vitality of the engulfed particles.

But these phenomena are not restricted to the spleen. When poisons capable of dissolving the red blood-cells are administered, the pigment is found scattered through all the organs in which this reticulo-endothelial system occurs, especially in the liver and in the lymphatic glands, less conspicuously (because less often examined?) in the bone-marrow. When Eppinger realized that the endothelial cells of the liver were identical in function with those in the spleen, he called them "the splenic tissue of the liver", and seemed to suggest that they are carried bodily from the spleen to the liver, whenever the former is overburdened or maimed. Lintwarew has shown that such a procedure actually occurs; and it is histologically evident that there is a permanent tissue as well. Aschoff's conception is, however, much more useful and suggestive.

The relation of the spleen to immunity is not merely a matter of its behaviour to the introduction of hæmolysins; its pulp-cells are concerned in the manufacture of the immune substances with which the body is furnished in the course of infections. Herein lies a

very important practical bearing in regarding the spleen as a member of the recticulo-endothelial system. The question is worthy of ample consideration.

In the early literature of splenic diseases the statement is not seldom found that the organ possesses, among its many functions, that of offering resistance to systemic infection. Its enlargement during some of the acute specific fevers, and in other conditions in which grave infections are present, was held to be an evidence that it was conspicuously active in defence. And experimental evidence, which was early sought, did at times appear to support this view; but such evidence was often conflicting. It was necessarily so; for no care appears to have been taken to choose healthy animals for experiment, and such results as were obtained were in part due, in all probability, to the existence in many of the animals of such diseases as would inevitably vitiate any conclusions. Of the early work, that of Pfeiffer and Marx* was the soundest. In investigating the formation of immune bodies in cholera, those authors found that the spleen and the medulla of the long bones contained a far larger proportion of these substances than any other part of the body; and this reservoir, so to speak, of defensive substances continued for many months, until the bactericidal properties of the blood were slowly brought up to the standard found in the spleen and the bones. They also found that immunity could be developed in an animal whose spleen had been removed some months before; but if the production of immunity was attempted and the spleen then at once removed, the immunity failed to develop. This suggests that the early removal of the spleen had afforded time for the vicarious functions possessed by the medulla of the long bones or other parts to have developed.

In 1891, Bardach† injected 25 normal dogs, and 25 dogs from whom the spleen had been removed, with 1 c.c. of an anthrax culture (rabbits are normally resistant to infection by anthrax). Of the 25 spleenless dogs, 19 died; of the 25 normal dogs, 5 died. Similar results were obtained when normal and spleenless dogs were immunized against anthrax before injection of the culture. The deaths in the spleenless dogs were more numerous.

Tizzoni and Cattani‡ injected cultures of the tetanus bacillus into three groups of rabbits: normal vaccinated, normal unvaccinated, and vaccinated spleenless. Animals in the first group resisted the inoculation; those in the last two groups succumbed. They were unable to render rabbits whose spleens had been removed immune against tetanus. It therefore appeared possible that the manufacture of a substance causing immunity was manufactured by the spleen. In their later work they seemed to realize, with Righi, that the removal of the spleen merely acts as any other major operation would, in reducing the general systemic resistance to infections. These results are not confirmed by some other experimenters, but, as a rule, too few animals were used by them to avoid the chance of error.

The most careful experiments hitherto conducted are those of Morris and Bullock.§ The following is a portion of their account:—

> Thirty-six apparently healthy young brindle rats, weighing from 50 to 100 grms. each, were splenectomized under ether anæsthesia. Great care was taken to guard against any operative complications, such as hæmorrhage or infection, and the subsequent autopsies showed that none had occurred. A similar number of control rats of like weight and breed were subjected to a laparotomy in which one testicle was removed. As the testicle is larger than the spleen, and the blood-vessels entering it are about equal in size to the splenic vessels, its transabdominal removal furnishes a very fair basis of comparison as to the effect of the operative trauma alone upon the subsequent health of the animals.
>
> Both sets of animals were found to be active and thriving on the day following the operation. They were then exposed to chance laboratory contagion and kept under observation for several months. Whenever an animal in either series died, an animal of the other group was killed, and both were completely autopsied. Microscopical sections were made from all important organs, and cultures were taken from the heart's blood and from the peritoneal cavity or lung.

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* *Zeits. f. Hygiein.*, 1898, xxvii, 272.
† *Ann. de l'Inst. Pasteur*, 1891, iii, 571.
‡ *Centralb. f. Bakteriol.*, 1892, xi, 325.
§ *Ann. of Surg.*, 1919, lxx, 513.

It was then observed that the splenectomized animals almost invariably died before the controls, and that the death-rate among them was 80·5 per cent as compared with 38·9 per cent in the normal rats. Necropsy showed the following lesions: Congestion and parenchymatous degeneration of nearly all the important organs, varying from injection of the vessels and slight cloudy swelling to focal necroses or extensive disintegration of the parenchyma. If the animal had survived long enough for a reparative process to set in, there was replacement of the degenerated areas by newly-formed granulation tissue.

They conclude from these results that the spleenless rats were more prone to contract the prevalent rat plague, and that, having contracted it, they showed less resistance to its ravages. A second experiment with 72 rats confirmed these results, and showed that under ordinary laboratory conditions spleenless rats were far less resistant to a common infection than normal rats. The conclusion is therefore drawn that the spleen must in some way help to protect the animals against infection, since removal of another organ of equal size and weight, by a similar operative procedure, caused no impairment of the defensive mechanism.

In a further experiment two groups of 88 rats each were treated, the one by splenectomy, the other by abdominal castration, and were then injected subcutaneously with a sublethal dose of broth culture of the bacillus of rat plague. Of the castrated rats, 22·7 per cent died; of the spleenless rats, 87·5 per cent died.

The conclusions which flow from these most careful and exhaustive experiments are that the spleen affords great aid in resisting infective processes in rats, and that its removal robs the body of its resistance, or diminishes that resistance until such time at least as compensatory processes have had a chance to establish it once again in its original strength. Hektoen's experiments* appear to show that antibodies are produced in the spleen, lymphatic tissues, and bone-marrow.

So far as I am aware, no observations to support these conclusions have yet been made on man. But the evidence as to the defensive properties of the spleen which these experiments reveal is so strong that remembrance of this function of the spleen should always be borne in mind when the operation of splenectomy is under consideration.

3. **The Spleen as a Member of the Digestive System.**—Although it is well known that the spleen undergoes variations in volume during the day, becoming larger up to a period of about four hours after every meal, diminishing subsequently as a result of muscular action, there is much difference of opinion as to the purpose of these changes. Some regard the spleen as a reservoir for surplus blood, while others believe that the periodic enlargement is concerned with the digestive processes in the duodenum and small intestine. This last view is supported by two observations: (*a*) That the blood shows a leucocytosis during the period of digestion; and (*b*) That the blood of the splenic vein is richer in leucocytes than that of the artery.

We owe our early knowledge of the relationship between the leucocytes and digestion chiefly to Hoffmeister and Pohl. The great increase of lymphocytes in the intestinal mucous membrane during digestion was demonstrated by the former; and the relationship existing between this and the kind of food taken was indicated by the latter. The leucocytosis is most evident after a protein diet. Examination of the blood of the superior mesenteric artery shows a great increase of leucocytes during digestion, although the increase is due to the neutrophiles and not to lymphocytes. Subsequent observers have sought to belittle these observations. There are some who deny the existence of an increase of the blood-cells during digestion; others, who admit that such an increase does occur, consider it to be merely a part of a natural cyclic phenomenon having no direct relationship to any food ingested. It has been suggested that the increase may be in the nature of a protective mechanism, whose purpose is to ensure the detoxication of the products of protein digestion. The evidence on the whole seems to indicate that there is a definite relationship between the type of the dominant cell in the blood, and the quality of the food ingested. Neutrophile leucocytosis follows a meal of proteids and fats; lymphocytosis follows a meal rich in carbohydrates.

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* *Jour. of Infect. Dis.*, 1915, xvii, 415.

It may be that the spleen is concerned with the destruction of the surplus lymphocytes liberated during the process of digestion. If so, this would account for the undoubted enlargement of that organ which then occurs, and also for the lymphocytosis which follows splenectomy, the agent responsible for the destruction of these cells being then absent.

The relation of the spleen to the liver must be of the most intimate character, for every drop of splenic blood passes into and through this organ. The connection is well shown in regard to bile secretion, for it is everywhere admitted that the bile-pigment is derived from hæmoglobin, though the exact mechanism of the conversion is not understood. Assuming that the hæmoglobin must be carried to the liver in the free state, Banti and Furno searched for it in that form in the splenic vein. They claimed positive results, but Pearce does not confirm their observations. In the belief that the spleen contributes a substance which dissolves red cells, the blood of the splenic vein was then searched for evidence of 'fragile' red cells. Hammersten, Chalin and Charlet, and more recently Pearce, have all failed to find evidence of such a condition. This work, as well as the experiments of Pearce made to determine the 'threshold' for hæmoglobin, and the work of Anitschkow and many others, including Widal, would appear, as I have previously urged, to be quite irrelevant when once it is admitted that the hæmoglobin reaches the liver within the bodies of wandering cells, and not in the free state.

The fact that splenectomy in dogs lessens the liability to jaundice from the introduction of hæmolytic substances, has suggested that the spleen prepares a substance directly concerned in aiding the work of the liver, and the fact that the urobilin becomes less plentiful in the urine when a case of pernicious anæmia has been treated by splenectomy, points in the same direction. The urobilin is the evidence of increased hæmolytic activity in the portal blood. But the attempt to explain certain clinical phenomena of diseases of the spleen in terms of a 'hypersplenia' (Eppinger) or 'dysfunction of the spleen' (Hirschfeld) is due to a misconception either as to the purpose of the spleen or as to the significance of hæmolysis.

It is probable that in splenic anæmia the benefits of splenectomy are due to the liver receiving less work to accomplish in a given unit of time. The cirrhosis in the later stages results from the presence of the same toxic substances which excite the fibrosis of the spleen; the liver shuts off, and entombs within a fibrous wall, those substances with which it fails adequately to deal.

In those cases of splenic anæmia in which gall-stones are developed concurrently, the irritant traverses the liver-cells and enters into the bile, causing precipitation and encapsulation within the gall-bladder. It may also be that the composition of the bile itself is altered, the raw material supplied to the liver being short of some constituent, so that the product subsequently precipitates more readily around organisms within the gall-bladder.

The relation of the spleen to the pancreas is suggested by the anatomical features. The blood from the tail of the pancreas meets the splenic blood soon after leaving the organ. The classical work on this subject is that of Herzen, who sought to establish the existence of a 'trypsinogenic function' of the spleen. All the bearings of this work were ably set forth by Bellamy in 1900. It seems quite clear that the splenic blood is definitely different in composition according to the digestive period in which it is collected. The experiments devised to show this were exceptionally clear and convincing.

More recently, Sajous* emphasizes the importance of what he calls the 'splenopancreatic ferment' which comes into action between the spleen and liver, apparently detoxicating the blood which bears the food products. The albuminoid substances are converted into benign products in the liver circulation, and are passed on to the body at large in order to supply the tissues with a high percentage of phosphorus. This author, as I have said, strongly emphasizes the view that the functions of the spleen, in so far as they are to be revealed by a study of the blood of the splenic vein, will be found to be connected with the cellular and not with the fluid portions.

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* *Internal Secretions*, 8th ed., 1919, 531.

A relation of the spleen to the *small intestine* is shown by the fact that splenic extracts powerfully excite intestinal peristalsis. Such extracts are the basis of the preparation 'hormonal', which has been so much vaunted as a remedy for constipation, for lethargic appetites, and so forth.

The position of the spleen as part of the digestive system is also demonstrable in terms of the *chemical composition* of the organ, and of the phenomena of *purin metabolism*. Horbaczewski drew attention to the endothelial cells as the visible link between cellular changes and the formation of the purins shown by chemical analysis. Many eminent chemists have elucidated this part of the subject. The subject of *iron metabolism* has constituted an important chapter in the story of researches into the functions of the spleen. Asher principally, in addition to Schmey, Kruger, Bayer, and others, has shown by many experiments that variations in output of iron go with variations in the activity of the spleen. Splenectomy results in increased loss of iron from the body. The part played by the spleen in *fat metabolism* has been studied microchemically, and it seems clear that this organ provides a link in that very complicated process of body metabolism. Experiments which have been made to show such a connection have not succeeded in Pearce's hands.

4. **The Spleen as a part of the Sympathico-Endocrine System.**—The endocrine organs are those which produce an internal secretion. They belong to two main groups. In the first are those which now produce, or have at some time produced, an external secretion also. The pancreas is the best instance of this type; others are furnished by the testis and the thyroid. The second group contains those organs which do not yield an external secretion, and have never done so. The former exert their action through the circulation; the latter operate through the sympathetic nervous system.

The spleen has never yielded an external secretion; it is intimately connected with the blood-stream, and at the same time it has extensive connections with the sympathetic nervous system. The splenic sympathetic plexus forms a dense network round the splenic artery and its ramifications within the spleen. This plexus is closely connected with the solar plexus, and therefore comes into connection with the adrenal glands. Besides this, the spleen receives branches from the vagus nerve which supply the muscular tissue of the capsule and the trabeculæ. The French writers have named this system 'parasympathetic'; the American writers 'the autonomic-sympathico-endocrine complexus';* but before we can accept or make use of the term 'autonomic instability' to explain the action of certain phenomena in connection with the spleen, much more detail is required upon the whole subject.

When Cohen asserts that 'gall-duct crises' are started by changes in the splenic end of the vasomotor chain, he reminds us not to omit the action of the nervous system from our calculations, without affording us that adequate knowledge which we crave.

Extracts of the spleen, including the proprietary substance called 'hormonal', have been shown by Berlin to have a similar action to that of cholin upon vasomotor nerves. Stern and Rothlin have found that extracts of the spleen are also capable of acting specially on smooth muscle, even in very minute doses. The active agents in the extracts are called 'lienins', and it is suggested that the spleen is concerned with the preservation of the tonus of the stomach, and of the intestinal and other smooth muscles. The action is aided by the presence of adrenalin.

The relations between the spleen and thyroid have been discussed by Klinger, Asher, Streuli, and Luciani. Removal of the thyroid will not kill an animal if the spleen be removed first. Massenti and Coronadi found that the spleen shrinks after thyroidectomy. Streuli's work goes to suggest that the spleen 'balances' the thyroid.

Investigations have also been made to ascertain if there are any special relationships between the spleen and the thymus gland. According to Bayer, the activity of the thymus is reawakened after the spleen has been removed.

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* *Osler Memorial of* 1919 (S. S. Cohen).

THE PATHOLOGY OF SPLENIC DISEASES.

The pathological changes found in the spleen can best be grouped according to the affinities which exist between the causative agents and the various parts of the spleen-liver system which they directly affect.

1. In the first type the provocative agent excites either a mechanical effect, or a local lesion, of the exact kind produced in other organs. The results will be expressed by the formation of an abscess, by a deposit of tuberculous nodules, by a metastatic new growth, and so forth.

2. In the second type, an organism lodges firmly in the pulp of the spleen without actually producing a gross lesion there. Like any irritant of chronic character, it induces changes in the reticulum akin to, or actually constituting, fibrosis. The best example of this condition is afforded by the chronic malarial spleen, wherein, according to modern experience, the parasites lie apparently inert for long periods, to appear from time to time in the general circulation as a consequence of some excitant, suspected or unknown. The tropical splenomegaly may be regarded as a similar example, since here also the parasites are found embedded in the splenic pulp. It is probable that many other chronic enlargements of the spleen may be regarded in the same light, and it seems not unlikely that spirochætal infections, whether syphilitic or of an unknown type, may account for many forms of fibrosis and of chronic diseases. The work of W. J. Mayo on cases of splenomegaly associated with incoercible manifestations of syphilis is referred to elsewhere.

3. The third type of process is that which is set in motion by toxic substances reaching the spleen from some nidus elsewhere in the body. Foci in the mucosa or submucosa of various parts of the alimentary canal, in which there is no frank suppuration, but merely a subacute inflammatory cell-infiltration of slight or moderate extent, are easily overlooked, especially in the examination of the dead body. In pernicious anæmia, of course, definite lesions of this kind have been discovered by means of a special technique, and have been considered by Hunter, who first recognized them, as the portal of entry of the causative infection.

Given the primary infected lesion, the course of the toxic substances continually poured out into the vascular system is identical (for a part of the circuit) with that of the blood through the spleen, liver, and bone-marrow. The toxic substances may be of various kinds, which may be named according to their action. They may remain in the blood-stream and act on the floating cells, or they may pick out certain tissues of the body. The selective power of streptococci (as shown by Rosenow) and of toxins is well recognized, and mutual affinity of soil and seed may also be present. There is nothing impossible, therefore, in conceiving that some toxins will affect the cells of the spleen-pulp exclusively, either causing degeneration in them, or stimulating them to increased activity. In either case the material which leaves the spleen may consist not only of the original toxin, but also of the products of degeneration or over-activity of the existing splenic cells. The poison contained in the blood leaving the spleen comes almost at once into contact with the blood from the stomach and the tail of the pancreas. In this way it may become altered enough to cease to have any deleterious action upon the cells next encountered, namely, the Kupffer star-cells and the other endothelial cells of the hepatic sinusoid, or the liver-cell itself. On the other hand, the toxic substance or substances may arrive at the liver unaltered, and there set up changes in the respective elements which go to make up the unit of liver-tissue. These changes are usually of a degenerative nature; but in some cases, owing to the toxins passing through the endothelium, reactive changes are excited in the fibre-cells enclosing the lobule. This is the beginning of cirrhosis.

Another series of changes results when the brunt of the action of the poisonous substances is borne by the hepatic cell itself. As occurs in other parts of the body, the passage through the cell may cause no damage, but may provoke changes in the parts beyond; in this case in the smallest beginning of the bile-channel. Here the bile itself may lose its fluidity, precipitates may form, which in the minute channels cause blockage and a mechanical biliary retention (with or without jaundice). Or it may

be that, without acting in any way upon the bile, the noxious substances first affect the endothelial lining of the bile-channels, and so set up some form of cholangitis.

In other cases, however, the liver-cell is itself affected, and a series of clinical phenomena dependent on failure of the hepatic function takes place. After that, the stereotyped secondary cirrhosis may occur.

Leaving the liver, the poisoned blood may pass through the heart and lungs without losing its toxic character, and may finally come in contact with the cells in the sinusoids of the bone-marrow, and interfere with their function, if there is any affinity between them. Where repression of function occurs, a certain type of anæmia results or a diminution in the number of the white cells which are being made there. Conversely, increase of white cells may occur, and leucocytosis form a conspicuous feature.

Sufficient evidence has now been accumulated to enable us to form some idea of the varieties of toxins which may enter or leave the spleen ; they are grouped according to their supposed actions ; as causing anæmia, hæmolysis, asthenia with muscular wasting, cirrhosis of the liver, fibrosis of the spleen, or proliferation of various cells capable of active increase (for instance in the germ centres of lymphoid follicles, or in the bone-marrow in myeloid leukæmia). Banti invoked the first three types to explain the disease which goes by his name.

1. The most active *poisons causing anæmia* ('anæmizing') are such as prevent the red cells from being formed. There is little doubt, however, that many substances are comprised in this group which produce anæmia rather by destroying the red cells or by rendering them vulnerable. In this case the phagocytes of the spleen-pulp become unduly active, and a complication is introduced, inasmuch as these pigment-laden cells carry their burden to the liver, disintegrate there, and overburden this organ, besides producing another and peculiar type of change—siderosis and proliferation of endothelial cells.

2. The *hæmolysing poisons* are important. They play the chief part in hæmolytic splenomegaly, and in some forms of severe anæmia, as well as in some special types of cirrhosis. Chevallier and Tourkine have been at much pains to insist on the dual character of the hæmolysing poisons, some of these having the property of actually destroying the red cells, while the others only cause them to become 'fragile'.

3. *Poisons which excite fibrosis* are very common. The process of fibrosis has been long assumed to be merely the last stage of an inflammatory process ; but there is evidence to show that fibrosis of the spleen may be a specific phenomenon, just as in the liver biliary cirrhosis is certainly the result of active and direct stimulation of the connective-tissue cells.

4. *The poisons which excite cell-proliferation* may concern the cells of the Malpighian bodies, as in lymphatic leukæmia and some kinds of Hodgkin's disease, or the cells of the spleen-pulp. In the latter case several things may happen. The pulp-cells may assume the properties usually restricted to the cells of the bone-marrow concerned with the formation of white cells ; in these circumstances bone-marrow cells are produced. If this should occur in a slight degree it is only revealed by microscopic examination. Instances of this action are afforded by various acute specific fevers. If it occurs in a greater degree the enlargement of the so-called splenomedullary leukæmia is brought about. Sometimes the pulp-cells develop enormous numbers of cells of all kinds, and so produce a tissue of very complicated structure, as in lymphosarcoma or Hodgkin's disease.

THE CLINICAL AND ASSOCIATED PHENOMENA IN SPLENIC DISEASE.

The clinical and other phenomena which occur as evidences of splenic disease may now be discussed as a corollary to the various matters so far considered. The list of symptoms and signs likely to be encountered resolves itself into a short one when the mechanical results which follow upon a gross enlargement of the organ, or upon the obstruction to the portal circulation by a terminal cirrhosis of the liver, are omitted.

1. **Anæmia.**— Anæmia is caused by many diseases. In this connection it is only necessary to consider the type of anæmia which rightly directs the attention of the clinician to the spleen as its cause. The preceding discussion has briefly dealt with the subject

of hæmolysis. It may now be asserted that a disease of the spleen is to be suspected when there is any evidence that hæmolysis is associated with anæmia. What exactly is the full significance of the term 'hæmolysis'? It may be taken to indicate the occurrence in orderly succession of the following events: a destruction of the red cells, the accumulation of their remains in the spleen, the ingestion of these remnants by the phagocytic endothelial and reticular cells, and finally the transmission of these engorged cells to the liver, in whose 'sinusoids' they are disintegrated preparatory to the absorption of their particles by the stellate cells of that organ. Hæmolysis will be rendered an easier, and therefore a more frequent process, if any diminution occurs in the resistance offered by the red cells to their destruction. Such a change has been described by Chauffard, who speaks of a 'dystrophy' of the red cells, a condition in which their vulnerability is increased, and there is consequently a special 'fragility'. It has been asserted that the presence of a fragility of the red cells indicates that the seat of any disease in which it occurs is in the spleen; but there is evidence to controvert this opinion. Such a fragility might be due either to an early error in the formation of red cells by which there was an attenuation (through defective supply of the necessary material) of their lipoid component, or to the inimical effects of a substance produced by bacterial agencies in some lesion, perhaps quite inconspicuous, in the mucosa of the alimentary canal.

But every anæmia associated with disorders of the spleen is not characterized by hæmolysis. There is another important group of anæmias in which the initial disorder is either in the bone-marrow (and in the later changes in the spleen) or is dependent upon the same cause as that which affects the bone-marrow. In this class of case, the medulla being directly damaged, the process of formation of blood-cells is inhibited, or even in some cases arrested. In Hodgkin's disease, for example, the bone-marrow may become involved, and the part concerned in the formation of red cells then undergoes atrophy. In this instance there is from the onset some agent which injures the spleen and bone-marrow almost simultaneously. The train of symptoms which follows the anæmia may then become masked in those far more conspicuous features which present the clinical picture of the original disease.

When once the process of hæmolysis has developed to the stage described above, the further course of events will depend on the manner in which the liver-cells cope with their increased burden. On the one hand, the poison (which has destroyed the red cells) may pass through the liver-cells without affecting them; the extra load imposed upon them is borne without injury. On the other hand, the poison may actually injure the hepatic cells, so that the excess of blood-pigment is disposed of with a steadily increasing difficulty. Then, at last, under a continued strain, the inadequacy of the liver may become apparent, either clinically in the form of jaundice, or pathologically by reason of the appearance of urobilin in the urine. The great functional capacity of the liver-cell accounts for the gradual, insidious, and tardy onset of the symptoms connected with the involvement of the liver in such conditions.

It is interesting to find that the clinical phenomena due to a hæmolysis are absent in those diseases in which the liver-cell is equal to its work and does not suffer impairment. In the enlargement of Hodgkin's disease, of myeloid and lymphatic leukæmia, of sarcoma of the spleen, of lymphogranuloma, all the phenomena associated with hæmolysis are characteristically absent. But none the less anæmia develops. The reason is, no doubt, the following:—

With the exception of the leukæmias, where the energies of blood-formation become overwhelmingly directed to the formation of white cells instead of red, these various diseases of the spleen are associated with progressive fibrosis; there is consequently a gradual interference with the normal capacity of the endothelial cells to remove effete red cells. This entails a loss of iron to the body. The liver-cells do not receive sufficient iron in that form which is suitable for reconstruction in the next step of the cycle. Even if phagocytes in other parts of the body assume the function of red-cell destruction, they have not direct access to the liver, and cannot therefore supply this organ with sufficient speed or adequacy. It seems quite clear, from the experiments in connection with iron metabolism, that the

spleen is situated where it is in order to enable the iron-laden endothelial cells to have a free channel for their passage into the minute capillaries of the liver, through which they are too large to pass.

2. **Jaundice.**—When jaundice arises as the result of a toxic process in the spleen-liver system, two matters require consideration. These are the site of action of the poison, and the nature of the poison. In splenic anæmia there is no primary interference with the activity of the liver-cells; it is only when cirrhosis develops in the latest stage that the cells become affected, and then only in an indirect manner by compression from without, rather than from disorganization within the cell. In hæmolytic splenomegaly, on the other hand, the liver-cells from the first are either poisoned or burdened beyond their normal capacity for dealing with blood-pigment. The remarkable tendency to cholecystitis and cholelithiasis in this disease suggests the passage of toxic substances into the bile, acting, perhaps selectively, upon the mucosa of the gall-bladder.

Jaundice does not necessarily appear, even though the process of disposal of blood-pigment is inadequately performed. The absence of jaundice, that is to say, does not justify the opinion that in any particular patient the successive steps in the cycle of the metabolism of hæmoglobin which have been taken between the spleen and liver are normal. When the blood-pigment is broken down, it gives rise to two portions, one free from iron, the other containing iron. The former, undergoing purely intramolecular change, appears in the liver-cell as bilirubin, and passes out into the bile capillaries; the iron-containing portion makes its way back to the site of the manufacture of the red cells. In disease, this story becomes modified, either at the first stage or at the second. The division of the blood-pigment molecule may not take place; hæmatin is then formed, and gives rise (it is supposed) to one of two substances (maleic imide, maleic anhydride), either of which being *colourless* will escape observation in the liver-cell. Or, on the other hand, the iron-free substance formed from the blood-pigment molecule may not become converted into bilirubin, but into a hæmopyrrhol, which is also colourless. In this case also, bile-pigment fails to appear in the liver-cells (and in the bile in the gall-bladder?) and jaundice is not present.

These considerations provide a suggestive basis for the explanation of the anomalies which appear from time to time in reported cases of cirrhosis associated with splenomegaly.

It has been stated above that the liver-cells become affected when cirrhosis occurs. It is desirable here to emphasize the mechanism of the production of cirrhosis, for the story is hardly complete without some reference to the pancreas. If so much has been said about the inter-relations of the spleen and liver, and so little about the pancreas, it is because there is a wealth of positive information respecting the former. If the secretion from the tail of the pancreas (where the islands of Langerhans are most numerous) plays a necessary part in the intravascular changes which take place between the spleen and liver, attention would naturally be directed to a determination of the frequency with which interstitial pancreatitis, focal or diffuse, is associated with splenic disease. Unfortunately our information is slender and uncertain. The direct connection between pancreatic disease and hepatic cirrhosis is at present clear only in one form of cirrhosis, the so-called 'pigmentary cirrhosis'. It may be that the cirrhosis begins merely as a consequence of the disturbance initiated in the spleen. It is clear that the presence of iron which is not in a suitable condition for reconstruction in the liver, aided by the direct action of a poison (modified by passage both through the splenic endothelium and the endothelial cells of the liver sinusoids), may excite an overgrowth of the fibre cells outside the liver lobules. If it should do so, not only will there be cirrhosis of the Laennec type, but there will also be a special form of pigmentary deposit. A purely hæmolytic poison, that is to say, has modified the process of disposal of blood-pigment, in spite of its own modification by the splenic products into a cirrhogenic substance. It is certainly significant that in such cases the pancreas not seldom shows a widespread change.

3. **Petechial Hæmorrhages.**—These are occasionally seen in cases of splenic disease, in leukæmia, and in von Jaksch's disease. They always denote damage to the endothelial cells of the capillaries in various parts of the body by a particular form of poison, named 'endotheliotoxin', because its effects are known and obvious, and because there is no

adequate knowledge indicating its chemical constitution. The minute petechial hæmorrhages are scattered through many organs, appear on serous surfaces, and may occur on mucous surfaces, as in the nose and on the gums or in the kidneys. In these cases they almost certainly denote the channel of excretion of the poison by which they are caused. Such clinical phenomena, as is well known, sometimes accompany the circulation of certain septic organisms or of the toxins derived from them ; they here signify a special property of the leukæmia and allied poisons.

4. **Muscular Weakness.**—This may be associated with an actual wasting of the muscle, which partly accounts for the emaciation noticeable in advanced cases of leukæmia and of splenic anæmia. When we remember the intimate association between the spleen and endocrine system, the question arises as to the extent to which the phenomena of muscular weakness and asthenia are to be attributed to a direct action upon the adrenal or thyroid glands. The inter-relation of these endocrine glands with each other and with the glands possessed of external secretions is only now being revealed to us by the work of many observers.

5. **Pyrexia.**—Pyrexia as a feature of splenic disease has only recently attracted close attention. There is a tendency to ascribe fever appearing in the course of diseases, hitherto regarded as intrinsically apyrexial, to a secondary infection with septic organisms, especially when the temperature curve, as is frequently the case, is intermittent. In Hodgkin's disease pyrexia is almost constant, is indeed regarded by some clinicians as almost essential to a correct diagnosis. In pernicious anæmia pyrexia runs in waves spread over three, four, or more weeks, to be followed by apyrexial phases ; in leukæmia there are also pyrexial periods. The question is raised at once as to whether each of these diseases may be of microbic origin. In hæmolytic jaundice fever occurs periodically ; it is generally slight, and lasts for two or three days. In other cases it is severe, but of shorter duration ; the temperature rises abruptly, remains at its maximum a very brief period, and falls quickly. There is the characteristic 'steeple' chart of cholangitis. In such cases stones are often, but not always, present in the common bile-duct.

6. **Splenomegaly.**—When the spleen is recognized, by any method of clinical examination, as being enlarged, it is certain that it is at least twice the normal bulk. Any enlargement less than this, and often even this, cannot be discovered by palpation or by percussion. Perhaps, taking an average of all cases, the very largest spleen is to be found in Gaucher's disease, the next largest in leukæmia, and the next in malaria, though occasional instances are found in this last disease in subtropical countries which surpass all others. Then comes a series in which the spleen is large, but not excessively so, and, finally, there are cases in which the spleen is not enlarged at all. Thus, the spleen may be involved in Hodgkin's disease without being clinically enlarged ; it is not always enlarged in pernicious anæmia, and its enlargement then bears no discoverable relationship to the gravity of the case. These aspects of the subject are so well known that this symptom is only referred to for the sake of drawing attention to the fact that an absence of enlargement of the spleen does not relieve this organ from the suspicion of being the source of a patient's illness.

7. **Leucocytosis.**—The significance of this phenomenon lies in the fact that it affords an insight both into the nature of the agent at work, and into the state of those tissues which are concerned in the manufacture of the leucocytes. There are some toxic substances which expend their whole baneful power upon the circulating leucocytes ; others affect their formative tissues ; while a few may act upon both. The action exerted may be one of stimulation, so that leucocytosis results, or it may be one of inhibition, and result in leucopenia. In pernicious anæmia the poisonous action on the bone-marrow affects the white cells as well as the red, so that a very low white-cell count is the rule. In hæmolytic jaundice, on the other hand, the action on the bone-marrow is one of stimulation, and leads to an increased outpouring of leucocytes.

Where the poisonous substances act upon the pulp-tissue of the spleen, upon the endothelium of the liver sinusoids, and upon the whole reticulo-endothelial system, exciting the dormant cells to form myelocytes (myeloid metaplasia), stray myelocytes can be found in the blood-stream. This occurs in some forms of acute splenitis, occasionally in Hodgkin's

disease, notably in infantile splenic anæmia, and sometimes in pernicious anæmia. The same process occurs in massive fashion in leukæmia, where every part of the reticulo-endothelial system competes against the rest in the effort to produce and pour out these abnormal cells. The pulp-tissue of the spleen then appears almost as a replica of ordinary bone-marrow tissue, and the immature cells pass freely into the blood-stream. In virtue of the character of these cells, which, strictly speaking, are not leucocytes, such a phenomenon should not be described as an extreme leucocytosis.

It is therefore not sufficient in any case of leucocytosis to determine merely the presence or absence of an increase in the number of white cells. It is necessary also to ascertain which varieties of cells are represented in the increase, and to recall the significance of each specific increase. An increase of the neutrophiles indicates the presence of toxins of nucleoprotein form, or of the products of dissolution of albuminous substances. An increase of lymphocytes denotes activity of poisons of lipoid character, with whose destruction these cells are especially concerned. The large mononuclear leucocytes are increased when the particles of abnormal matter are large enough to be microscopically visible. When the eosinophiles are increased, it may be concluded that the poisonous substances have an affinity for the sympathetic nervous system, although the relation of these cells to the integrity of the nervous system is not the only one they possess. Poisons may accumulate in various tissues and set up local accumulations of these cells (as in Hodgkin's disease) and at the same time excite the bone-marrow, the spleen, and the lymph-glands to join in the over-production of these cells.

The tubercle bacillus and the spirochæte of syphilis are well known to secrete lipoid substances; the association of lymphocytosis with these diseases is to be expected. That stimulation of the lymphocyte formation occurs in pernicious anæmia, splenic anæmia, and Graves' disease indicates the direction of the inquiry to be made into the ultimate causation of these diseases.

8. **The Spleen and the Hæmorrhagic Diathesis.**—During recent years the suggestion has been made that the spleen may in some degree be concerned with the life-history of blood-platelets. In a patient suffering from purpura hæmorrhagica there is a decided diminution in the number of platelets, and the spleen is enlarged. After splenectomy the normal conditions are restored; in proportion as the number of platelets is increased, so the clinical symptoms disappear. Cases illustrating this experience are recorded by Schmidt,* Benecke† and Kaznelson.‡ The name 'splenogenic thrombolytic purpura' has been given to this condition, and a 'thrombocytolytic syndrome' is described. It is supposed that there is an increased destruction of platelets by the cells of the reticulo-endothelial system. If, however, the whole of this vast system is implicated, it is not easy to understand why extirpation of the spleen should cure the disease or relieve the patient of symptoms. Katsch§ has reported cases of thrombopenia where there is no purpura; and, conversely, cases of purpura where the number of platelets is not diminished.

9. **Urobilin in the Urine.**—Recent work shows that the presence of this substance in the urine is an indication of functional inadequacy of the liver cell, which is accompanied by some degree of obstruction in the minute extracellular bile canaliculi. A certain quantity of bile escapes through the ducts, undergoes the usual transformation into stercobilin in the intestine, re-enters the liver, but cannot find a free exit through the hepatic cells. The significance of this phenomenon is that there is an increased breakdown of red cells and hæmoglobin, and that there is a state of cirrhosis in the liver; the degree of disturbance of function is in proportion to the degree of 'fragility' of the red cells. Viewed in this light, the next step to be followed, after arriving at a conclusion that the spleen is diseased, is to determine the degree of damage to the liver, and instead of regarding cirrhosis as a collective term for many distinct morbid entities, to view all cirrhoses as representative of degrees of implication in the one morbid process.

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* *Wien. klin. Woch.*, 1918, 487, 959.
† *Therap. d. Gegenw.*, 1917, Dec.
‡ *Deut. med. Woch.*, 1918, 5.
§ *Münch. med. Woch.*, 1918, 33.

PERNICIOUS ANÆMIA. ADDISON'S ANÆMIA. IDIOPATHIC ANÆMIA.

(*See Fig.* 230.)

The literature of pernicious anæmia is inexhaustible. But bulk is no index of value. It is only within recent years—and especially since the work of W. Hunter, and of W. J. Mayo, Percy, and others—that some enlightenment has been thrown upon a difficult and complex problem.

The first case of idiopathic anæmia was recorded in 1822 by Combe, who applied this term to it. As Hunter says, the problem which this disease has presented throughout its whole history was never more clearly stated. Combe was recording "a well-marked instance of a very peculiar disease which has been altogether overlooked by any English author with whose writings I am acquainted. Unfortunately, however, such is the allowable diversity of opinion on most medical subjects, that it is very possible the following case (disease) may be viewed in different lights, and receive different appellations; and while some may be disposed to regard this anæmia as constituting a morbid state *sui generis*, others may consider the defect in red circulatory mass (so extreme that every organ in the body, with the exception of the spleen, was deprived of its red blood) as an accidental and occasional circumstance denoting some peculiar change in the assimilative powers, the primary stages of which we have been unable to detect. Doubtful myself which of the two opinions may be the most correct, I shall do little more than state correctly the phenomena of the case, and minutely, the appearances presented on dissection. One remark only I may at present offer—that if any train of symptoms may be allowed to constitute anæmia a generic disease, the following may be considered an example of it in its most idiopathic form".

This description of Combe's case apparently attracted no attention. In the year 1855 Addison, in his *Disease of the Suprarenal Capsules* (pp. 2, 3), gave an account of the disease which, in fullness of detail, accuracy of statement, and beauty of language, has never been surpassed. As a preface to his description of what we now called 'Addison's disease', he considered that it might not be without interest or unprofitable to give a brief narrative of a form of anæmia the cause of which was not discoverable. It was whilst seeking to throw some additional light on this form of anæmia that he stumbled upon curious facts which led to his discovery of the disease of the suprarenal capsules which now bears his name. His account is as follows:—

"For a long period I had from time to time met with a very remarkable form of general anæmia, occurring without any discoverable cause whatever; cases in which there had been no previous loss of blood, no exhausting diarrhœa, no chlorosis, no purpura, no renal, splenic miasmatic, glandular, strumous, or malignant disease. Accordingly, in speaking of this form of anæmia in clinical lecture, I, perhaps with little propriety, applied to it the term 'idiopathic' to distinguish it from cases in which there existed more or less evidence of some of the usual causes or concomitants of the anæmic state.

"The disease presented in every instance the same general character, pursued a similar course, and, with scarcely a single exception, was followed, after a variable period, by some fatal result. It occurs in both sexes, generally—but not exclusively—beyond the middle period of life, and so far as I at present know, chiefly in persons of a somewhat large and bulky frame, and with a strongly-marked tendency to the formation of fat. It makes its approach in so slow and insidious a manner that the patient can hardly fix a date to his earliest feeling of that languor which is shortly to become so extreme. The countenance gets pale, the whites of the eyes become pearly, the general frame flabby rather than wasted; the pulse perhaps large, but remarkably soft and compressible, and occasionally with a slight jerk, especially under the slightest excitement; there is an increasing indisposition to exertion, with an uncomfortable feeling of faintness or breathlessness on attempting it; the heart is readily made to palpitate; the whole surface of the body presents a blanched, smooth, and waxy appearance; the lips, gums, and tongue seem bloodless; the flabbiness of the solids increases; the appetite fails; extreme languor and faintness supervene, breathlessness and palpitations being produced by the

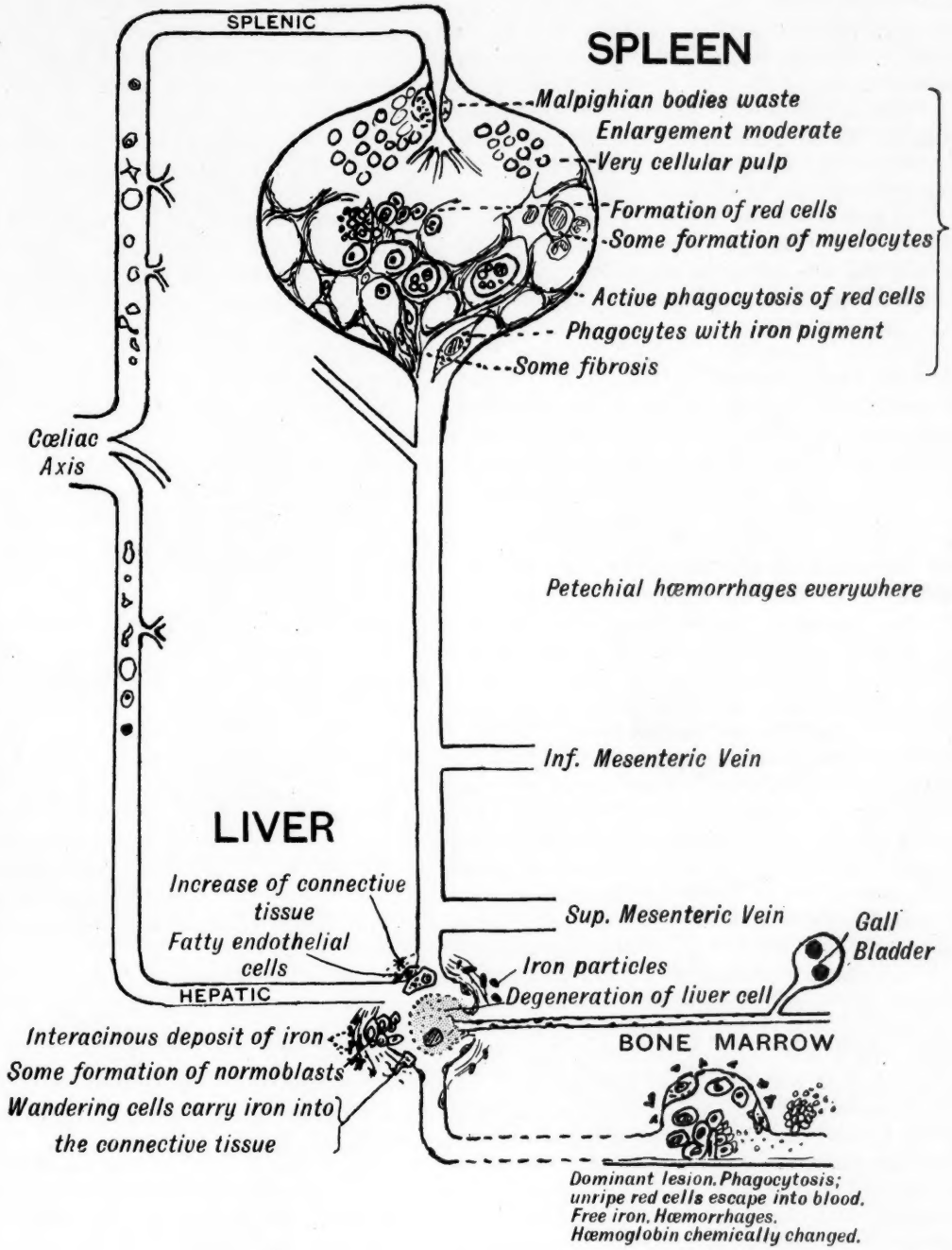

FIG. 230.

THE CHIEF CHANGES IN PERNICIOUS ANÆMIA.

most trifling exertion or emotion; some slight œdema is probably perceived about the ankles; the debility becomes extreme, the patient can no longer rise from his bed, the mind occasionally wanders, he falls into a prostrate and half-torpid state, and at length expires; nevertheless, to the very last, and after a sickness of perhaps several months' duration, the bulkiness of the general frame and the amount of obesity often present a most striking contrast to the failure and exhaustion observable in every other respect.

"With perhaps a single exception, the disease, in my own experience, resisted all remedial efforts, and sooner or later terminated fatally. On examining the bodies of such patients after death, I have failed to discover any organic lesion that could properly or reasonably be assigned as an adequate cause of such serious consequences."

In the year 1871 Biermer described cases of this disease, apparently believing that it had not been observed by earlier writers. His claim to be the first to recognize the disease excited the wonder of the physicians in this country, especially those on the staff of Guy's Hospital. His writing, however, undoubtedly stimulated interest in the subject, and popularized the knowledge then possessed with regard to it. He gave to it the name 'progressive pernicious anæmia'. The work of William Hunter began in the year 1888. Between 1888 and 1890 he developed his views as to the hæmolytic nature of the disease, its toxic cause and gastro-intestinal site; and between 1890 and 1900 he elaborated and expounded his thesis that the disease owned an infective etiology. In 1907 he wrote: "Addison's anæmia is in truth a very remarkable disease, of a specific infective hæmolytic nature, in which both clinical observations and necropsy reveal definite hæmolytic and infective processes as a constant feature of the disease, and in which a very definite series of points can be got out of the history throwing light on the mode of origin of the disease, and the source of the infection in the alimentary tract, and of the lesions of the tongue, stomach, and intestine connected with it".

The treatment of pernicious anæmia by arsenic was introduced by Byrom Bramwell.

It has long been the custom to speak of anæmia as '*primary*' and '*secondary*'; the latter being the consequence of some disease or dyscrasia, one of whose manifestations is expressed in terms of blood-change; the former being a change occurring in the blood apart from any other change in the body. The definition of an anæmia as 'primary' involves a belief in the existence of the blood as an organ whose cells are capable of undergoing degeneration or destruction as the consequence of a morbid process limited to itself. But as Vogel points out,* the blood is not itself an organ, but is the direct product of the activity of the various hæmopoietic organs or systems, and may in a sense be more properly regarded as a secretion than as an organ. The erythrocytes having relinquished their nucleus can no longer be regarded as true cells; and the leucocytes have the power of reproduction only in a very limited degree, if at all. The terms 'primary' and 'secondary' therefore do not hold the meaning they are intended to convey.

Within the normal blood the elements are in a state of unceasing change. This change, nevertheless, maintains the blood in a state of equilibrium. Cells are constantly dying, and undergoing destruction; and cells are constantly being formed to replace those which are lost. An anæmia may result in consequence either of the diminished production of red cells or of the increased destruction of red cells, or perhaps of both. The anæmias which arise as a result of diminished production of red cells include those seen in cachexias, wasting diseases, tumours, toxic anæmias, aplastic anæmia, etc. The anæmias which arise as a result of the increased destruction of red cells include those seen in cases of hæmorrhage, in hæmolytic icterus, in the anæmias due to hæmolytic poisons, pyrodin, phenylhydrazin, toluylenediamine, etc., and some forms of intestinal parasite, and so forth. In the latter group pernicious anæmia is included. There is in this disease, as Mott first showed, an abnormally great cell destruction, with a pathologically increased demand on the blood-forming tissues rather than an inadequacy on the part of these to meet the normal demand. But to say only this is to say no more than is true of the condition hæmolytic jaundice; yet, whatever the affinity between these two diseases may be,

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* *Jour. Amer. Med. Assoc.*, 1916, lxvi, 1012.

their clinical manifestations and their destiny are very dissimilar. In pernicious anæmia the red-cell-forming tissue in the bone-marrow is also profoundly affected by the hæmolytic poison, and is subject to a double stress; it is stimulated to over-production at a time when it is fighting to ward off the attack of a poison attempting its destruction. So great is the effort of the bone-marrow to meet the demand made upon it that the parent cells of the erythrocyte are liberated before their offspring daughter and granddaughter cells are created. The greater the urgency of the demand made upon the bone-marrow, the earlier is the type of cell liberated and set adrift in the circulation. The character of the nucleated cell set free may therefore be an index of the gravity of the disease. Death occurs in pernicious anæmia because of the persistence of the increased destruction of red cells at a time when the efforts of the medulla to form blood break down under the ceaseless heavy strain imposed upon it. It will be recognized at once that the conditions existing in this disease, in so far as the changes in the blood and in the organs producing blood, are concerned, resemble those seen in the embryo; a "reversion to the embryonal type of hæmatopoiesis" is spoken of as a characteristic of the disease.

If, then, the disease is primarily a hæmolytic process, a process in which red-cell destruction is the outstanding feature, what is the nature of the poison, and whence does it come? Hæmolysins of definite origin are known. In the hæmolytic anæmia of pregnancy a definite hæmolysin has been found in the placenta. In the anæmia due to bothriocephalus, cholesteryl oleate, set free by the decomposing segments of the worm, affords the poison for the red cells, although every harbourer of this parasite is not equally susceptible to the action of this substance. In some forms of cancer, especially of the stomach and ascending colon, poisons appear to be liberated which cause a blood-picture hardly distinguishable from that of pernicious anæmia. Chronic carbon-monoxide poisoning among charcoal workers, industrial-lead, and perhaps also arsenic, poisoning appear to operate in the same manner. It is suggested that hæmolytic substances formed by pathological bacteria in the intestine may gain access by this route, as first suggested by Hunter.* J. H. King,† after careful study of three cases of pernicious anæmia treated by splenectomy, and after conducting a series of experiments upon dogs, concludes, "In pernicious anæmia, hæmolytic jaundice, and cirrhosis of the liver, the hyperactive spleen unfavourably influences the anæmia through its regulation of the highly hæmolytic unsaturated fatty acids of the blood. The removal, therefore, appears to be indicated. Splenectomy of itself, besides influencing the production of hæmolytic, unsaturated fatty acids, raises the percentage of antihæmolytic substances in the blood; that is, the total fats and cholesterins".

The work of the surgeons in the last few years has afforded some evidence, if not as to causation at least as to associated conditions, in cases of pernicious anæmia. N. M. Percy, whose work on this difficult disease has been marked by a most earnest devotion and remarkable success, has pointed out that since his attention was especially directed to the testing of Hunter's view of the infective origin of pernicious anæmia, he has found evidence of infective foci in 95 per cent of cases. In a consecutive series of nine operations for pernicious anæmia, all specimens removed (spleen, gall-bladder, appendix) were sent at once for pathological examination. Bacteria were grown from 3 of the 9 spleens, from 4 of the 7 gall-bladders, and from 6 of the 7 appendices. The only case not giving a bacterial growth was one in which pyorrhœa had long been present. The chief organism found was the hæmolytic streptococcus (7 cases); in 5 the *Bacillus coli* was found; in 4 *Streptococcus viridans*. Smithies, of Chicago, has grown bacilli and cocci of the hæmolytic type from infected areas about the teeth, tonsils, and accessory sinuses. In a series of 24 cases, preceding the 9 just mentioned, Percy records the following gross lesions. In 20 there was chronic cholecystitis with or without gall-stones; in 17 of these there was evidence of old disease in the appendix; in 6 there were infective foci in connection with the teeth, and in 1 in connection with the tonsil.

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* *Brit. Med. Jour.*, 1907, ii, 1299. † *Arch. of Internal Med.*, 1914, xiv, 145.

A detailed description of the symptoms and the diagnosis of pernicious anæmia is not necessary. But I may be allowed to quote from a description kindly sent to me by Dr. N. M. Percy, of Chicago, whose experience of the surgical treatment of this disease is unsurpassed. Dr. Percy has been impressed with the importance and constancy of the following conditions, and believes them to be of such importance that their presence or absence may well decide the diagnosis in a difficult case :—

1. *Achlorhydria.*—In all cases where a test was made, with one exception, no trace of free hydrochloric acid was found in the fasting contents and in the specimens of test meal. The exception was a very early case, and showed a very low hydrochloric acid content. A few cases were in such an extreme condition that it was not deemed advisable to subject them to the strain of passing the stomach tube. In all other cases the gastric analysis was part of our routine in making the diagnosis. The absence of free hydrochloric acid occurred with such regularity that I would hesitate to make a diagnosis of pernicious anæmia in any case showing the presence of free hydrochloric acid in the stomach unless it be a very early case and the acid content very low.

2. *Tongue.*—The appearance of the tongue was noted in every case, which revealed a peculiar smooth, glossy surface. In some this was present only on the sides of the tongue, in others its whole surface was involved. This appearance of the tongue, which was always present but in varying degrees, is due to an atrophy of the mucous membrane and sometimes due to a hyperplasia of the tongue muscle bundles. A glossitis was present in a large per cent of our cases. Hunter lays particular emphasis upon the lesions in the mouth, and claims there is no other anæmia in which glossitis is so constant and persistent. The appearance of the tongue is so constant that it may be considered the most important external sign of pernicious anæmia.

3. *Pigmentation.*—Pigmentation was found to be present in the majority of cases, especially on the backs of the hands. In some this may be diffuse, in others freckle-like.

4. *Hypertension (chronic nephritis).*—It is noted that hypertension (chronic nephritis) frequently co-exists with pernicious anæmia, both probably being due to chronic infection, but have no definite connection with each other. The cases having high blood-pressure were of middle age or beyond. Strange as it may seem, the hypertension persists through periods of severe weakness and with a blood-count as low as one million or under, only letting down when the patient becomes extremely ill in the terminal state of the disease.

The disturbance of renal function which accompanies marked cases of pernicious anæmia, as pointed out by Christian, was noted in many of our cases. The disturbance is similar to that found in patients with advanced nephritis, but is not accompanied by hypertension or any other evidence of chronic nephritis. The disturbance seems to be due to the anæmia, and subsides as this improves. It is important from the standpoint of prognosis to determine in each case whether the disturbance of renal function is due to the anæmia or to chronic nephritis.

5. *Diarrhœa and Vomiting (intermittent).*—Attacks of diarrhœa and vomiting, especially the former, were frequently noted, and were found difficult to control by medical means. These cases yielded readily to blood transfusions, followed by administration of large doses of hydrochloric acid. Vomiting invariably stopped immediately after transfusion, and the diarrhœa usually subsided within a few days. In a number of instances an attack of diarrhœa was the first symptom of the disease noted by the patient.

6. *Nerve Manifestations.*—The nerve symptoms noted were many and varied, ranging from the most common, that of tingling in the fingers and toes, to those simulating tabes and multiple sclerosis. The tingling sensation in the fingers, the presence of which varies from time to time, was noted in practically every case. Marked psychical disturbances were noted in some cases.

The characteristic appearance of the tongue, the pigmentation, and the achlorhydria occurred with such constancy that their presence may often be the deciding factors in the diagnosis.

Splenectomy in Pernicious Anæmia.—In the year 1913 three observers independently, and for different reasons, suggested the performance of splenectomy in cases of pernicious anæmia. Eppinger* advocated the operation because he had observed a diminished output of urobilin, and other evidences of diminished hæmolysis, after the spleen had been removed for other conditions ; and he assumed that in pernicious anæmia, a disease of exaggerated hæmolysis, the removal of the spleen would control or counteract this tendency. De Castello† was guided by the observations of himself and others as to the great benefits resulting from the operation in the related conditions splenic anæmia and hæmolytic jaundice. Klemperer‡ was influenced by the clinical observation that splenectomy for such simple conditions as laceration was, in some instances at least,

* *Berl. klin. Woch.*, 1913, xxix, 2409. † *Deut. med. Woch.*, 1914, xl, 639.
‡ *Therap. d. Gegenw.*, 1913, liv, 385.

followed by polycythæmia. Advocacy by all of these men of great repute soon led to a wide adoption of the practice in Germany, and an adoption, not so general, in America. In England very little was done. The results, which were not long in coming, showed that the mortality of the operation was high, that the immediate benefit which not seldom followed was transient, that post-operative complications were frequent, and that, with few exceptions, the general course of the disease was not materially altered. That splenectomy alone might offer help seemed probable from the work of Robertson,* who found, in cases studied by himself, that the rate and degree of hæmolysis in pernicious anæmia underwent a constant and marked decrease after removal of the organ. Largely owing to the work of W. J. Mayo and his most able band of colleagues, and of N. M. Percy, a wider view of the necessities of these cases was taken, with a great improvement in results. The anæmic condition of the patients was improved by transfusion of whole blood; and foci of infection, possibly 'primary', but certainly co-existent, in the mouth or accessory sinuses, or in organs laid bare by the abdominal operation, were removed. The purpose of the extended operations consisted, as Percy said, of three main factors: (1) An attempt to stimulate the production of new blood by massive 'step-ladder' transfusions of whole blood; (2) An attempt to overcome the absorption of hæmolytic bacteria or their toxins by the radical removal of local foci of infection; and (3) An attempt to protect the newly-formed and older red cells by removing the spleen. Each of these steps is important. The 'step-ladder' transfusions bring about an elevation, step by step, of the quality of the patient's blood in respect of red cells, hæmoglobin content, etc.; they supply blood which is not only useful in itself, but acts also in a manner stimulating and nourishing to the bone-marrow, encouraging it to still further efforts. The eradication of active foci of infection relieves the patient of a chronic toxæmia which is possibly an etiological factor. The removal of the spleen reduces the abnormal amount of blood destruction. Discussion has recently ranged around the question as to whether transfusions frequently repeated are competent of themselves to produce an improvement in the patient's condition equal to that seen when both transfusion and splenectomy, or these two with the addition of the eradication of infective foci, are undertaken. Under what circumstances may these steps of treatment be taken? They are useless in the 'aplastic type', and they are of little value, if any, in cases where cerebral or spinal symptoms are already present, unless the anæmia is profound, when transfusion alone may give some degree of transient benefit. In all other cases the repetition of a blood transfusion about every eight or ten days gives very striking results. They are briefly stated by Percy:—

> The red blood-count is increased, often doubling immediately if the count is very low. The hæmoglobin percentage rises and the number of platelets is increased. The blast-cells become more numerous, and occasionally Howell's particles will appear in the blood, indicating a stimulation of the bone-marrow. The general appearance and the appetite of the patients improve at once, the condition of the mouth (glossitis is not infrequent) clears up, and sleep returns. It is not only that new blood is given; it appears certain that a great stimulation of the (under-nourished?) bone-marrow occurs. In those patients who are much improved by transfusions the question of splenectomy should be considered; it should not be countenanced unless such improvement has been unmistakable. Before it is performed, a search for foci of infection outside the abdomen will have been made, and all accessible disease removed. When an abdominal operation is undertaken its scope must be comprehensive. Percy's work has shown how necessary a wide inspection is, and how safe the extended procedure may be made. In a private communication he tells me that in 77 laparotomies performed by him the spleen, gall-bladder, and appendix were removed in 54 cases; the spleen and gall-bladder in 11; the gall-bladder and appendix in 4; the spleen alone in 4. There were 8 deaths. In 74 of these patients one or more transfusions had been performed before operation; in 40 a transfusion was undertaken immediately after operation; in 10 cases a later transfusion was performed.
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> Of the 69 cases that left the hospital, 5 had recurrence of symptoms at the end of four months, and died at intervals of eight to twelve months; 10 had recurrence at end of six to eight months and followed about the same course. Forty-eight were in good condition at the end of twelve months. Of these, 12 are alive at the end of two years, 9 at the end of three years, 4 at the end of four years, 5 living nearly five years after operation, and 1 a little over six years. Two of the five-year cases have been retransfused, one several times, the other only twice. The one living six years

* *Arch. of Internal Med.*, 1915, xvi, 429.

since operation has had no transfusion since operation. Two of the four-year cases have been back for transfusions, as have also 4 of the three-year cases, 5 of the two-year cases, and 8 of the one-year cases.

The progress of the 4 cases in which gall-bladder and appendix were removed without the spleen was not so good, in any instance, as was the average of other cases. They did not experience the immediate remission of the average case of the other group, and all of them had an early recurrence of their anæmia, which had been temporarily improved by the transfusions. The spleen was not removed in these patients because it was not enlarged and there were no adhesions to indicate that there had existed a splenitis or perisplenitis. It is evident that some of our patients should not have been operated upon, as undoubtedly just as good or better results would have followed transfusion alone.

There were 45 cases treated by transfusions without surgical procedures other than those for the eradication of local foci of infection when present. In 10 of these, most of which were of the aplastic type, no marked improvement resulted. In 12 cases, all of which presented evidence of cerebral or cord involvement, some improvement was noted in the blood-picture and general condition, but the nerve destruction progressed, without interruption. In 23 cases the transfusions brought about a marked improvement, and in some a very rapid remission of the disease resulted. In no instance was the remission as complete as it was in several of the cases which were operated. The longest remission noted following a series of transfusions was eleven months; the majority, however, required transfusions at much shorter intervals. There are still 2 patients enjoying fair health after the lapse of nearly two years since their first transfusion.

Dr. W. J. Mayo has very kindly given me the record of all cases of splenectomy performed in the Mayo clinic up to Sept. 20, 1920. The following are the results in the cases of pernicious anæmia :—

There were 53 cases with 3 deaths, a mortality of 5·6 per cent.
Five patients were living between four and five years after operation.
Eleven patients were living between three and four years after operation.
Twenty-two per cent of patients lived two and a half times as long as the average.

What may be said, then, of the efficacy of splenectomy in this disease? In the first place it cannot be claimed, and is not claimed, that any patient has been cured of his disease. The risks run in undergoing the operation are small, but not so insignificant that they can be ignored. A few lives are sacrificed. All the patients who survive are not benefited, but in the majority a degree of improvement results, and a prolongation of life, in greater comfort and with increased zest, can be recorded. The truth is approximately this, that as a result of repeated transfusions of blood, removal of the spleen, and eradication of all foci of infection, one-quarter of the patients are greatly improved, living happier and more useful lives, prolonged beyond the expectation by a period of two or three years; one-half of the patients are improved in some degree, they feel better, take nourishment better, sleep better, and live perhaps a few months, or even a couple of years longer than the average; the remaining one-quarter of the cases do not receive any help greater than that which could be derived from careful medical treatment, which may include the 'step-ladder' transfusions of blood if these are found to be helpful, and the treatment of such foci of infection as can be found in the mouth, nose, or accessory sinuses. When the position is accurately stated to patients who suffer from this disease, they are likely to decide the matter according to their temperaments. Surgeons should rarely, or never, urge operations, for they should rarely, or never, find it necessary to do so if the problem to be decided is fully and honestly stated to a patient or his relatives. In cases of pernicious anæmia an operation is indicated for those patients who are found by such tests as I have mentioned to be likely to do well, and who are eager to get the most out of the remainder of their days and to prolong them.

LEUKÆMIA.

(*See Fig.* 231.)

To turn over the pages of the history of leukæmia is to see recorded in orderly succession many of the chief features in the growth of our knowledge concerning human pathology and hæmatology. A case of this disease was first recorded in 1845 by Hughes Bennett, of Edinburgh. The spleen was greatly enlarged, and the blood, examined after

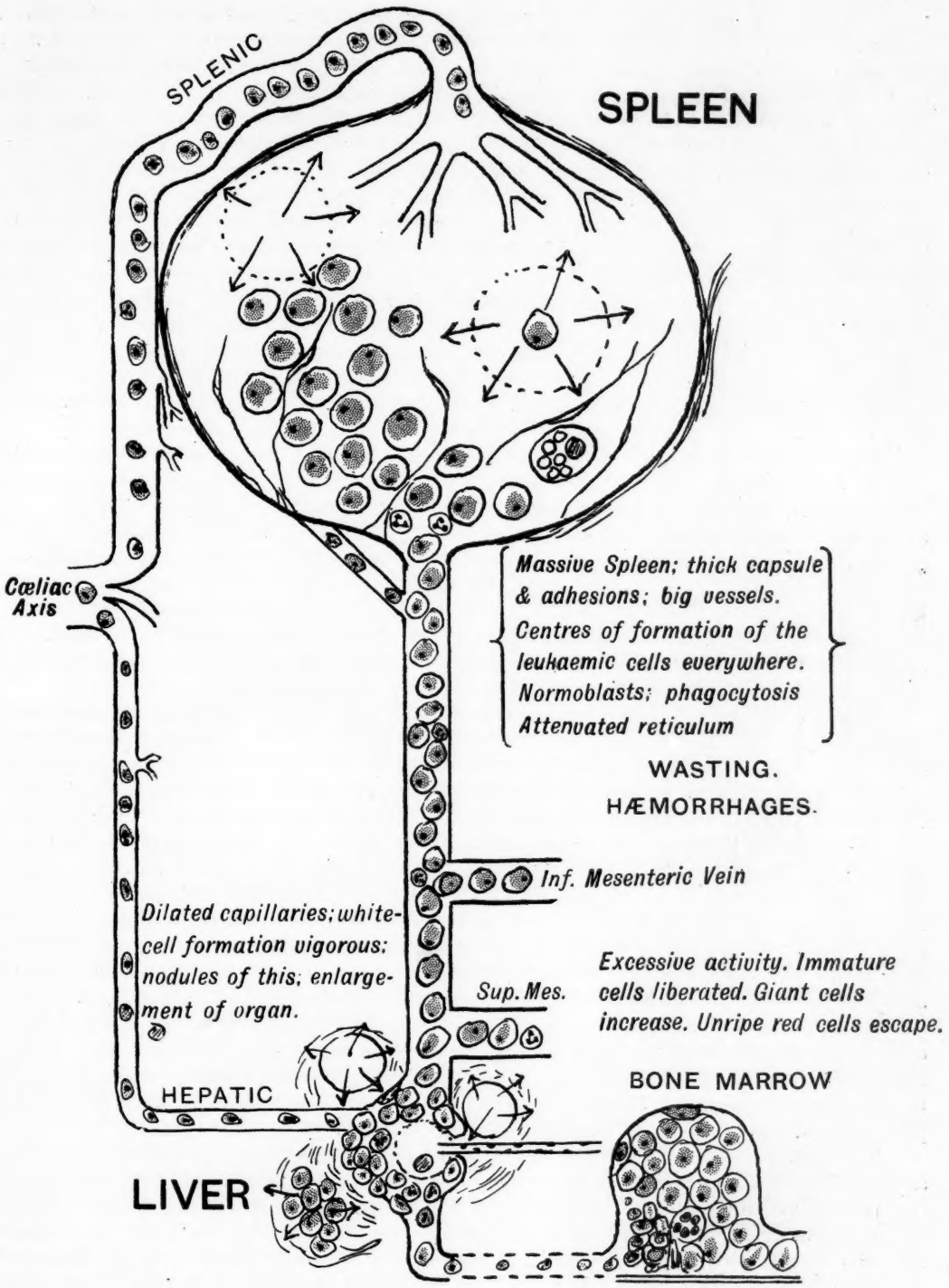

FIG. 231.

THE CHIEF CHANGES IN LEUKÆMIA.

death, was seen to contain a large number of cells similar to those found in the ordinary purulent discharges from wounds. Hughes Bennett described the condition as one of "suppuration of the blood". One month later Virchow described a similar case. A rather acrimonious contest for priority arose, and different views were expressed as to the nature of the white bodies found in the blood. Virchow asserted that they were not to be distinguished from the colourless corpuscles or leucocytes of the blood. Hughes Bennett had regarded them as pus-cells. But the discussion lost all its significance when it was recognized that pus-cells and leucocytes were identical. Virchow, we may well suppose, was interested, not so much in the purely clinical phenomena which his case displayed, as in the question of its intrinsic nature. He regarded "the blood as a transitory tissue with a fluid matrix, constantly changing because constantly developing", and he showed that the cells of the blood are continually perishing and continually being replaced. The occurrence of a disease such as this was for him the confirmation of his opinion as to the nature and constitution of the blood, for he had, as it were, foreseen that such a disease as this would be likely to exist. When once his prediction that there was a 'white blood' was confirmed by the examination of the blood in this disease, the problem at once arose as to the nature of the process involved in the excessive production of leucocytes, and as to the nature of the tissue changes present in this disease.

The study of these questions led to an intensive study of the cellular processes occurring in suppuration. Neumann, in 1878, showed the active part played therein by the bone-marrow, and Ehrlich (1898) demonstrated that it was possible by using aniline dyes as stains to differentiate between the various types of cell activity awakened by this process. From this time, the knowledge of the floating cells of the body has advanced with great rapidity; and the intimate relationships which exist between the cells circulating in the blood, the cells in the blood-forming organs, and the cells met with in inflammatory infiltrations of all kinds, have by degrees been brought to light. The changes in the blood of living patients were first described in 1846 by Dr. Fuller, of St. George's Hospital, and Dr. Walshe, of University College Hospital.

Virchow sought to place the primary seat of this disease in the spleen and in the lymphatic glands. He believed that the changes in the blood arose from the liberation into it of chemical substances which were normally retained within these organs. The cells of the blood were stirred to a greater activity by these substances, and ultimately the cells of the various organs also showed evidence of hyperplasia.

The original belief of the great pathologist received corroboration from Neumann's discovery of the state of the bone-marrow in this disease. As a result of this, leukæmia was then regarded as a disease of the spleen, lymph-glands, and bone-marrow, an interpretation not essentially different from that held to-day. But the subsequent history of this disease shows many vicissitudes. Difficulties were continually arising in the interpretation of details; and in spite of most assiduous research by many observers, no real advance was made in our knowledge of the disease until the work of Pappenheim.

As a result of the investigations of this worker and his school, the origin and fate of every type of cell found not only in leukæmia but in every 'blood' disease, and in every inflammatory process, was thoroughly investigated by special staining methods applied to all manner of tissues: to those removed by operation as well as to those obtained by post-mortem examination, in man as well as in animals.

The modern science of hæmatology received immense impetus from all this work, and a host of earnest students in all lands were eager to lend their help. The question in this disease resolved itself into an inquiry as to whether the abnormal blood-cells were formed in one organ or in many, thence to be distributed to all parts of the body; or whether the cells were formed 'locally', that is, in the parts where they were found. It was an old problem re-stated, the problem as to whether the exudates occurring in inflammation were due to chemiotaxis and the migration of leucocytes from afar; or whether (as was the original view) these cells are developed at the seat of the disease. The general opinion of those most competent to express one, now appears to be that the origin both of these

inflammatory cells and of the leukæmic cell-infiltration is local. This is a matter of great interest, and the historian will recall that in the year 1863, Beale, a solitary voice heard only to be opposed and derided, stoutly defended his opinion that the phenomena of tissue infiltration were the result of the irritation of the endothelial cells of the smallest local capillaries.

Leukæmia may therefore be considered as a morbid process manifesting itself diffusely, and consisting of hyperplasia of various leucocytes—sometimes of the lymphocytes, sometimes of the myeloid cells scattered throughout the body. The severity of the degree of hyperplasia may be so great, and the type of cells produced may be such, that what is called a 'sarcoid' process results. There are cases in which, however, the newly-formed cells are found in the spleen, lymph-glands, and bone-marrow, but do not enter the blood-stream; the blood on examination is normal. 'Leukæmia' therefore may be regarded as having two relationships: on the one side to the disease known as lymphosarcoma; on the other to Hodgkin's disease.

The search for the cause of this disease would be fruitless without the clear conception that leukæmia is a disorder in the process of the formation of white blood-cells, whose birthplace is the endothelium of the reticulo-endothelial system. We have therefore not to search a particular organ to find the cause of the disease. We have to discover the type of agent likely to affect so diffusely distributed a system of cells. We should be able to explain why, in some cases, the proliferative process goes on outside the blood-vessel and produces a massive deposit of new tissue without altering the appearance of the blood (resulting in Hodgkin's disease), whereas in other cases the proliferating process extends into the lumen of the vessel and allows the myriads of newly-formed cells to enter the circulation and produce a typical condition known as leukæmia.

It was Pappenheim who elaborated the thesis that the virus at work may travel either by the lymphatic channels (producing a 'lymphatic leukæmia') or in the blood-channels (producing a 'myeloid leukæmia'), and that the purpose of an inquiry should be to ascertain the nature of the stimuli or irritants capable of exerting such effects.

Symptoms.—The first and striking clinical feature is that the disease does not always run the same course. On the one hand there are acute forms in which a fatal issue ensues within a few weeks; on the other, the disease may last for many months, or, usually from two to four years, or even, as in a case recorded by Grawitz, for ten years. The duration of the chronic cases depends to a certain extent upon the circumstances of the patient. The necessity for earning a livelihood, even though the work is not heavy, has a very harmful influence upon the course of the disease.

Acute Leukæmia is no doubt commoner than appears from the literature, owing to the non-recognition of cases. It begins very suddenly, and is characterized by the severity of its symptoms, which follow acute tonsillitis or stomatitis. Hæmorrhages, as in scurvy, especially from the gums or nose, form an important feature, and in a few cases general glandular enlargement is noticed. The remainder of the clinical course strongly simulates that of typhoid fever, with rapid wasting, and a degree of mental disturbance which sometimes ends in delirium. Jaundice, when present, is attributed to enlargement of the glands in the hilum of the liver, which cause pressure upon the hepatic duct. An exfoliative dermatitis has been noted. The blood-picture may be either 'lymphatic' or 'myeloid'.

Chronic Leukæmia is usually of very insidious onset. A slow progressive wasting becomes noticeable, and carries with it increasing lassitude, asthenia, and loss of mental activity. In this case also there is a tendency to hæmorrhages, usually from the nose, sometimes from the intestine, or under the skin; infrequently from the gums, from hæmorrhoids, from the stomach, uterus, or urinary passages. Ulceration of the lips and mucous membrane of the mouth is not seldom seen, and may suggest an examination of the blood to confirm a tentative diagnosis. Periods of fever are usual. Physical examination reveals a massive enlargement of the spleen; less massive enlargement of the liver; in the 'lymphatic' cases there is enlargement of the lymph-glands in various places. Every system of the body may show changes, so that patients in respect of their most

troublesome symptom may come before ophthalmologists, dermatologists, gynæcologists, urologists, and surgeons, as well as physicians.

Studies in the metabolism of this disease have been extensively made. Perhaps the chief change in this respect has reference to the metabolism of the purin bodies. Uric-acid excretion is high; indeed, uric acid calculi may form. Charcot-Leyden crystals have been found in the blood and tissue-juices after death.

When a patient suffers from an added infection, the enlargement of the spleen and lymph-glands may diminish, and return almost to the normal; the blood-picture alters, the myelocytes disappear, and the polynuclear leucocytes greatly increase. The change, however, lasts only so long as the infection is present. As that fades away the conditions of the disease return. The injections of normal splenic extract, or of spermin, or of cinnamic acid, have restored the blood-count to normal for a time. As mentioned later, the administration of benzol produces a profound change in the state of the blood. Some cases have been reported in which a concurrent tuberculous lesion led to shrinkage of the spleen.

Neither age nor heredity appears to have any influence upon the disease. It does not occur in epidemics. Injuries have sometimes been considered a cause. Animals, cows, horses, dogs, cats, and fowls are said to suffer from the disease. So far no bacterial cause for it has been discovered, in spite of arduous and protracted search. Many of the clinical features could be easily explained as the result of a microbic infection; the acute form is clinically very similar to one of the acute specific fevers. It is true that many organisms have been found associated with the disease: micrococci, staphylococci, in lymph-glands; streptococci in the acute cases seen in America; and other organisms. These are instances, almost certainly, rather of chance secondary contaminations than of causative agencies. Attempts have been made to transmit the disease experimentally by the injection, intraperitoneally or intravenously, of leukæmic blood, but no success has followed. Transmission has occurred from one fowl to another. An examination of the abnormal leucocytes has shown peculiar cell-inclusions, but no evidence exists that these are to be regarded as parasites. So many of the features of the disease are 'toxic' that a further research for a biological cause is worth while. It has been suggested that the 'toxic' features are due to secondary infections occurring in patients whose normal protective neutrophile leucocytes are gravely diminished in numbers and in efficiency, being overwhelmed by the abnormal cells. It is possible that the absence of the normal leucocytes may account for the wasting seen in this disease, for many of the processes enacted in the tissues are deprived of the help which it is the part of these cells to give.

TREATMENT.—Until recent years no treatment seemed to have any considerable effect in cases of leukæmia. In the year 1909, Selling, of Johns Hopkins Hospital*, reported three cases of poisoning by benzol, two being fatal. The patients suffered from purpura hæmorrhagica with aplastic anæmia, and the bone-marrow was found aplastic. The red cells showed no changes other than slight pallor and anisocytosis. No regeneration forms of the red cells and no normoblasts were found. Platelets were few. There was a diminution in the granular type of leucocytes, and a relative increase in mononuclear types. Leukopenia was present.

In 1912, Koranyi† observed the effects of benzol poisoning in girls working in a factory where benzol was used as a solvent for rubber. The symptoms produced by this drug suggested to him the possibility of its use in the treatment of leukæmia. In reporting his experience, he states that there were no failures with benzol in cases of chronic leukæmia; that the spleen and lymph nodes were little affected; that benzol given alone was of benefit, but, although more gradual in its effect than the *x* ray, it succeeded where this failed; and that patients responded better to benzol treatment after the spleen had been exposed to *x* rays. No serious ill-effects were observed to follow the treatment, but certain disagreeable symptoms were noticed: a sense of burning in the stomach, and the eructation of

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* *Johns Hop. Hosp. Bull.*, 1910, xxi, 33. † *Berl. klin. Woch.*, 1912, xlix, 1857.

offensive gas, with transient catarrh of the trachea and bronchi, and giddiness. In one case the white cells were reduced from 220,000 to 8000 within three months; and the general health improved considerably. Dr. Frank Billings,* who reports a series of five cases treated by this drug, was impressed with it as a very powerful agent, and as one apparently of great promise in the treatment of leukæmia; but it was 'a two-edged sword' which, used carelessly, might defeat the purpose of its use and produce an equally serious condition, namely aplastic grave anæmia, with a hypoplastic bone-marrow, and result in a fatal issue. He noted a diminution in the size of the spleen, a rapid fall in the number of the leucocytes, and, in all the cases of a myelogenous type, an improvement of the red-cell count and hæmoglobin. Later experiences have confirmed many of these opinions; but it was soon found that there were cases resistant to treatment by benzol, and that in others a short period of improvement was followed by a rapidly fatal termination. Such dramatic endings to the disease occur both without treatment and with other forms of treatment, but benzol seemed often to be a factor in causing an earlier death than had been anticipated. The pure drug is administered in capsules containing about 1 grm., and olive oil is given simultaneously to diminish the irritating local effect. A dose of 5 grms. daily is gradually reached. When the leucocyte count is reduced to 20,000 the administration is stopped. Boardman† states that 16 out of 100 cases failed to show improvement, and that another 8 cases, although reacting favourably at first, died during or soon after the discontinuance of treatment.

The application of radium produces the most astonishing effects in reducing the size of the spleen. Within eight or ten weeks a spleen which appears to occupy almost the whole of an enlarged abdominal cavity shrinks until it is only just palpable beneath the costal margin. If the abdomen is marked week by week to indicate the size and shape of the tumour, the evidences of rapid shrinkage are very remarkable. As the spleen diminishes, the general condition of the patient steadily improves, and the blood-count approximates to the normal. In a very interesting paper Ordway† discusses the whole question of radium therapy very fully, and illustrates the improvement seen in cases under his care by photographs. He draws the following conclusions:—

1. Surface applications of radium in leukæmia produce striking, indeed remarkable, improvement in: (*a*) The blood-picture, which becomes almost normal; (*b*) The size of the spleen and glands, which are reduced almost to normal; (*c*) The general condition of the patient, who, from being emaciated and weak, may become plump and strong.

2. The duration of the remission is variable; it may last from months to years.

3. The results of radium treatment are not regarded as curative. It is believed to be, however, the safest as well as the most prompt palliative measure in cases of chronic leukæmia, whether refractory or not to benzol or *x*-ray treatment.

From the results of radium therapy in leukæmia it is believed to be the best form of treatment now at our disposal.

The fact which was clearly established by this work and by similar experiences at the Radium Institute in London in cases under the care of Hayward Pinch, led to the inference that the spleen might possibly be a factor of greater significance in the etiology of the disease than had been supposed. This view was strengthened by the further experience that the exposure of the long bones, or other parts, as well as the spleen, to the action of radium, did not produce results in any degree better than those in which the spleen alone was treated. As a result of the work at the Mayo clinic, by W. J. Mayo, Balfour, Giffin, and others, it seemed not improbable that if the spleen were a factor of causal significance, its removal, when it had been greatly reduced in size by the application of radium, and when the patient's condition was at its best, might be of benefit to the patient. In the old days removal of the spleen has been undertaken because the organ was grossly enlarged; the new view was that the smaller the spleen the safer its removal would be.

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* *Jour. Amer. Med. Assoc.*, 1913, lx, 595.

† Quoted by Ordway, *Boston Med. and Surg. Jour.*, 1917, clxxvi, 490.

The first case in which the spleen was excised in myelogenous leukæmia is recorded by T. Bryant, in 1866,* and the second by the same author in 1867. Both patients died as a direct consequence of the operation; in both the spleen was very large. After this splenectomy, was performed on many occasions in this disease, and by no means all of the cases found their way into surgical literature. The condition in most of these was profoundly unfavourable; the patient was in grave ill-health, and the spleen was of very large size; indeed, only those patients appear to have been selected for surgical treatment in whom the mammoth spleen was a serious and burdensome discomfort. The mortality up to the year 1900 is said to have been just under 90 per cent. Bessel Hagm† gave the records of 42 cases, with 38 deaths, and 'temporary improvement' in 4. I know of a few cases, all fatal, occurring before this date, which never found their way into the literature. In 1908, J. B. Johnston‡ recorded a further 7 cases, of whom 2 lived to show slight improvement after the operation.

H. Z. Giffin§ reports that the total number of cases appearing in the literature up to Jan. 1, 1918, is 51. Of these, 43 died at once: 8 showed a temporary improvement; but of these, 4 died within so short a period of the operation that their death should count as a fatality from it. If this is done the mortality is to be reckoned as 93 per cent. It is not surprising to find that all voices speaking with authority, such as Bland-Sutton's, were raised against a continuance of such surgical work. The record was a martyrology.

The experience of the Mayo clinic is epitomized in the following summary by Dr. Giffin:—

1. Twenty patients with myelocytic leukæmia have been splenectomized—18 of them after preliminary treatment by means of radium exposures over the spleen. The spleen and the leucocyte count were very much reduced by means of radium, and the general condition of the patients was greatly improved.
2. One patient died—an operative mortality of 5 per cent. The operative mortality of cases reported in the literature in which little or no preliminary medical treatment had been given was 86 per cent.
3. Ten of the 20 patients are living in good general condition from nine months to one year and seven months following splenectomy. However, these patients have not yet outlived the life expectancy for the disease.
4. Of 7 patients operated on within six months of the onset of the disease, 6 are alive.
5. It is probable that, at least in certain chronic types of myelocytic leukæmia with fibrous spleens and relatively low leucocyte counts, splenectomy may be justifiable for the comfort of the patient.
6. A review of the cases at this time reveals no evidence that the duration of the disease is altered in any definite way by splenectomy.

The statistics of the Mayo clinic up to Sept. 20, 1920, which Dr. W. J. Mayo has kindly given to me, show a total of 26 cases with 1 death, a mortality of 3·8 per cent. The immediate mortality is therefore strikingly different from that which occurred when the cumbersome size of the spleen was the chief indication for the removal of the organ. The last report shows, too, that 5 patients are in good condition and 2 in fair condition after periods of time beyond the life expectancy of the disease. It is interesting to learn that two cases, supposed to be early examples of myelogenous leukæmia (not included in this list) have been cured, or at least have lived many years after the operation. Dr. Mayo writes: "The operation is not difficult after radium treatment, and in selected cases should be further considered".

HODGKIN'S DISEASE.

In the year 1831, Hodgkin, Lecturer on Pathology at Guy's Hospital, observed a series of cases in which the spleen and the lymphatic glands were enlarged.‖ Among these were four examples of the condition now known as 'Hodgkin's disease'. All

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* *Guy's Hosp. Rep.*, 1866, xii, 444.
† *Arch. f. klin. Chir.*, 1900, lxii, 188.
‡ *Ann. of Surg.*, 1908, xlviii, 50.
§ *Med. Record*, 1918, xciv, 1020.
‖ *Trans. Roy. Med. Chir. Soc.*, 1832.

remembrance of this paper seems to have been lost, for in the year 1862 Wilks, then Lecturer on Pathology at the same Hospital, described the same disease under the title 'anæmia lymphatica'. By the year 1865 Wilks had, however, discovered the previous description by Hodgkin, and though his own observations were entirely original, he suggested, as a title for the disease, the name it has ever since borne, 'Hodgkin's disease'.

The morbid anatomy of the condition has been investigated since by a great number of observers, among whom Reed, Longcope, and Andrewes deserve special mention. A number of diverse views have been held as to the nature and causation of the condition.

One of the most recent writers, Mellon,* considers that the disease has not any relationship with tuberculosis—as Sternberg asserted,—with lymphosarcoma, or with pseudoleukæmia. The prevailing view of most of those who have recently investigated the condition appears to be that all these diseases should be regarded as disorders of the reticulo-endothelial system, probably infective in origin, and therefore to be classified as infective granulomata or "lymphomatosis with granulation-tissue formation". In his review of recorded cases Mellon found only two in which it seemed possible that the spleen was the primary focus of the disease; in neither was an autopsy obtained, yet the necessity for this could not be better shown than in a case recorded by Mellon as coming under his own care. In this there was no evidence of glandular enlargement, and a primary splenic origin of the disease seemed most probable. After death the inguinal, bronchial, and retro-peritoneal glands all showed hyperplasia of the lymphoid cells, and endothelium with multinucleated giant cells. The spleen showed advanced changes; the lymphoid tissue of the splenic pulp was practically obliterated by the intense proliferation of the hyaline connective tissue. There were many areas of anæmic necrosis which indicated that the disease in the spleen was of long standing. A similar case was recorded by Wilks in 1856. The patient was a man who died in Guy's Hospital in an extremely debilitated and anæmic state, with an enlarged spleen. The autopsy showed that the mediastinal and lumbar glands were very much enlarged, although the superficial glands were quite healthy.

The true nature of the disease has baffled inquiry. It may be regarded as a separate and distinct disorder having no ostensible attachment to any other. Or, alternatively, it may be regarded as a special form of a certain type of morbid process which exists also in other conditions—tuberculosis, pseudoleukæmia, and lymphosarcoma. The latter opinion has the advantage of correlating various morbid states as to the nature of which there has long been confusion, and attributing them all to one common underlying cause.

Hodgkin's disease has, as its essential anatomical feature, the presence of tumours made up of granulation tissue. The lesions differ from those of tuberculosis partly in the heterogeneous character of the inflammatory cells concerned in the formation of the nodules, and partly in the fact that the original cells of the affected tissues undergo active multiplication. The ordinary structure of the glands or spleen becomes lost in the abundance of lymphocytes, which appear intermingled with those epithelial cells, giant cells, fibre cells, and eosinophile leucocytes, all of which together help to build up the masses found in Hodgkin's disease.

In the reticulo-endothelial system there are the following two types of disease. There is that in which the cells undergo an intense proliferation and are liberated into the blood, as in the leukæmias. And there is that in which the proliferation goes on outside the vessels without the entry of any of the new cells into the blood. The microscopist, studying the spleen and allied organs, might well believe that he had an ordinary leukæmia tissue under examination, although the clinical phenomena might make such a diagnosis impossible. For him, the nature both of Hodgkin's disease and of leukæmia is essentially the same, and the state of the blood (upon which the clinician lays so much stress) is a mere incident. The following classification, for help in the preparation of which I am indebted

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* *Amer. Jour. Med. Sci.*, 1916, cli, 704.

to Dr. Gruner, embraces all the disorders of the reticulo-endothelial system, and shows, as well as our present knowledge allows, their relationship to each other :—

DISORDERS OF THE RETICULO-ENDOTHELIAL SYSTEM.

I. *Those in which there is an excessive formation of specific tissue elements.*

A. With the appearance of cells which are normal to blood-forming tissues :—

1. The cells grow away from the vascular channel :
   i. The disorder is disseminated throughout all parts of the system : (Disseminated) PSEUDOLEUKÆMIA.
   ii. The disorder is *focal.*
      a. In the lymph-glands : LYMPHOMATOSIS ; also in TYPHOID lesions.
      b. In the bone-marrow : 'MEDULLARY PSEUDOLEUKÆMIA'.
      c. In the spleen (and liver) : 'LIENAL PSEUDOLEUKÆMIA'.
2. The cells grow partly into the vascular channel, so that myelocytes appear in the blood : ACUTE SPECIFIC FEVERS ; VON JAKSCH'S ANÆMIA.
3. The cells grow mainly in the vascular channel. Therefore large numbers of myelocytes (or lymphocytes) appear in the blood :
   a. Disorder in the lymph-glands or lymphatic tissues : Clinically acute or chronic LYMPHATIC LEUKÆMIA.
   b. Disorder in the bone-marrow, spleen-pulp, or any 'myeloid' tissue : Clinically acute or chronic MYELOID LEUKÆMIA.

B. With the appearance of entirely new cells :—

1. Definite tumour-formation :
   a. Widely disseminated through the body : LYMPHOSARCOMA.
   b. Only local masses : in the spleen : LYMPHOSARCOMA.
   in the bone-marrow : MYELOMA.
   in the lymph-glands : CHLOROMA.
2. Definite tumour formation not present, but tumour cells are intermingled with myelocytes or lymphocytes of large size : 'SARCOID' LEUKÆMIA.
   (Each of these may also show 'leukæmic' blood.)

II. *Those in which there is excessive formation of the stroma cells.*

A. One kind of cell is noticeably predominant in the tissues :—

1. Fibre cells : PASSIVE CONGESTION OF THE SPLEEN ; SYPHILITIC SPLENOMEGALY ; MALARIA ; KALA-AZAR ; CIRRHOSIS with SPLENOMEGALY.
2. Epithelioid cells : GAUCHER'S SPLENOMEGALY.

B. Many cell-types involved, so that a granulation-tissue tumour is formed :—

1. Disseminated through the whole system : HODGKIN'S DISEASE ; LYMPHOGRANULOMA.
2. Local, e.g., in the spleen only (very rare) : primary HODGKIN'S DISEASE ; TUBERCULOSIS OF SPLEEN ; GUMMATA OF SPLEEN.

III. *Those in which there is an excessive formation of stroma cells with disturbance of the formation of the specific tissue-cells* : PERNICIOUS ANÆMIA ; SPLENIC ANÆMIA ; HÆMOLYTIC JAUNDICE ; SPLENOMEGALY IN RICKETS.

The histological study of these diseases suggests a similarity, if not an identity of causation, both for the widely disseminated lesions, and for those in which a definite 'tumour', such, for example, as lymphosarcoma, occurs.

The clinical symptoms of Hodgkin's disease are very familiar. They are largely mechanical in origin, and are due to the presence of widespread glandular enlargements which may press upon important structures. The periodic pyrexia of this disease may be regarded as a specific and typical feature. It is uncertain as to whether it is sometimes, or often, the result of secondary infections.

The symptoms certainly suggest the existence of a definite infection. There is a latent period, with occasionally slight swellings of the glands. A stage of declared disease may then begin quite abruptly. There may be a sudden general enlargement of the lymphatic glands, which themselves cause pressure symptoms, recurring attacks of fever, with increased heart action, and progressive wasting. It is said that the blood often shows no change, but it is very probable that an increase of the large mononuclear leucocytes and transitional cells is generally to be expected.

TREATMENT.—It is only very rarely that an operation upon the spleen is necessary in a case of Hodgkin's disease. I have performed one such operation. The case occurred in a man, 44 years of age, who had a colossal enlargement of the spleen with no discoverable change in any of the lymph-glands. Under radium the spleen diminished rapidly in size, but after two months again began to increase and became as large as ever. A second and third application of radium caused an equal reduction, and when the spleen was small I removed it. It showed the typical evidences of Hodgkin's disease, and this diagnosis was confirmed by the later enlargements of the cervical glands on both sides, which receded after the application of radium. The original operation was performed twenty-two months ago, and the patient is still in good health and at work. It is very doubtful if the removal of the spleen has had any effect, good or ill, upon the progress of the disease.

The general treatment of the disease needs no mention here.

SPLENIC ANÆMIA. BANTI'S DISEASE.

(*See Fig.* 232.)

HISTORICAL.—'Banti's disease' is the name given to the condition described in 1883,* and again in 1894,† by Guido Banti, of Florence. In 1866 Gretzel‡ described a clinical condition of anæmia associated with splenomegaly to which Griessinger applied the name 'splenic anæmia'. The case occurred in a child 10 months old who suffered from dysentery and severe anæmia, with considerable enlargement of the spleen, and enlargement, less considerable, of the liver and lymphatic glands. Examination of the blood showed that the proportion of white to red cells was not increased; the condition was therefore not leukæmic. In 1871 Wood § described a 'splenic form' of pseudoleukæmia, and reported a case in which the spleen was greatly enlarged, and there was severe anæmia without leucocytosis. Banti, in his later description mentioned above, considered the disease as possessing clinically three stages, merging gradually into each other. These stages were: (1) One in which there was enlargement of the spleen and a secondary anæmia—the duration being three to twelve years; (2) One in which the liver gradually enlarged, and the amount of urine underwent progressive diminution—the duration was brief; (3) One in which the liver gradually shrank in size and ascites appeared, the symptoms being those of an ordinary atrophic cirrhosis—the duration of this stage was between one and two years. The disease was invariably fatal, and death occurred either from hæmorrhage, or from auto-intoxication from cirrhosis.

In a third publication, Banti ‖ asserts that the disease is also characterized by the following definite pathological changes: (1) The chief change noted in the spleen is a fibrosis of the Malpighian follicles, spreading outwards from the central artery, which often shows a hyaline degeneration; (2) There is fibrosis of the splenic reticulum, with narrowing of the splenic veins, a thickening of the splenic capsule, and of the trabeculæ, larger and smaller, running through the organ; (3) Endophlebitis, with calcification of the splenic veins, extending up to, and even into, the portal vein; (4) Cirrhosis of the liver, of the 'Laennec type'; (5) The characteristic red marrow of a secondary anæmia; (6) There is no general glandular involvement.

Banti's hypothesis is that there is a primary splenomegaly due to an infectious agent. The splenic enlargement itself produces another toxin which, acting on the liver and on the splenic veins, produces the changes just described. The anæmia is the result partly of the toxæmia and partly of the hæmorrhages. The hypothesis is unnecessarily complex, for there is no reason why a single infective agent should not produce effects alike in the liver and in the spleen. The production by a sclerosing organ of a toxin destined to cause sclerosis in another organ is unknown elsewhere.

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* "Dell. anæmia splenica," *Arch. L. Schula Anat. pathol.*, Firenze, 1883, ii, 53.
† *Sperimentale*, xlviii, 407.
‡ *Berl. klin. Woch.*, 1866, ci, 212.
§ *Amer. Jour. Med. Sci.*, 1871, lxii, 373.
‖ *Folia Hæmatol.*, 1910, x, 1.

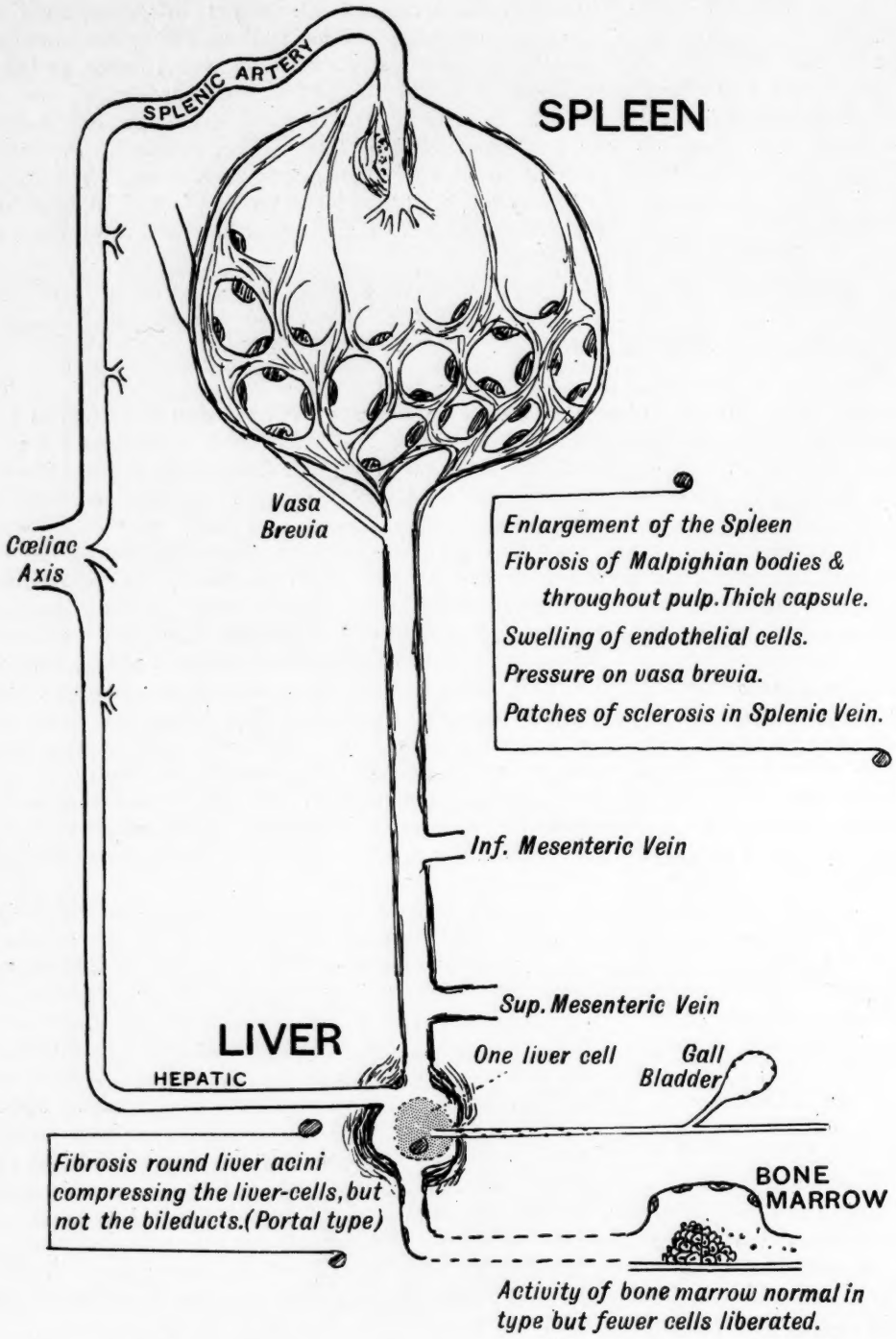
SPLENIC ARTERY
SPLEEN
Vasa Brevia
Cœliac Axis
Enlargement of the Spleen
Fibrosis of Malpighian bodies & throughout pulp. Thick capsule.
Swelling of endothelial cells.
Pressure on vasa brevia.
Patches of sclerosis in Splenic Vein.
Inf. Mesenteric Vein
Sup. Mesenteric Vein
LIVER
HEPATIC
One liver cell
Gall Bladder
Fibrosis round liver acini compressing the liver-cells, but not the bileducts. (Portal type)
BONE MARROW
Activity of bone marrow normal in type but fewer cells liberated.

FIG. 232

THE CHIEF CHANGES IN SPLENIC ANÆMIA.

The difficulty in the strict recognition of Banti's disease, as he describes it, is great; for there are many conditions with symptoms very closely resembling those described by him, and the chances of obtaining a pathological examination of the spleen and its vessels, and of inspection of the liver, are so remote, in view of the restriction of operative treatment, that an accurate diagnosis is only then obtainable after death. The etiology in Banti's disease is held to be unknown. If, therefore, a case clinically and pathologically resembling Banti's disease has a known causation, it cannot be accepted as an example of this disease.

Again, both clinically and pathologically the conditions in certain cases may so closely resemble those of Laennec's cirrhosis that many authors have considered that there are not two diseases, but one disease with different names.* If the ordinary clinical course is followed, there is no doubt that in Banti's disease the splenic enlargement precedes the affection of the liver, whereas in Laennec's cirrhosis the liver is first attacked; though in some cases the splenic enlargement may be so considerable as to distract attention from the less obvious change in the liver.

The truth appears to be that a large clinical group of cases, distinguished by enlargement of the spleen and a secondary anæmia, is being gradually encroached upon by keener distinctions than formerly existed, pathological and etiological. Griessinger's original description of splenic anæmia included, for example, the condition we know now as Gaucher's disease, the disease now called 'hæmolytic jaundice', and that form of infantile pseudoleukæmia called von Jaksch's disease. In connection with the latter, the view is taken by some observers that it is an infantile form of Banti's disease in which " a moderate leucocytosis, due to the higher values of leucocytes in the normal blood of infants, is to be found " (Mayo).

Splenomegaly associated with anæmia may have its etiology determined and so be withdrawn from the group of 'splenic anæmia'. This has happened, for example, in connection with chronic syphilitic enlargements, with the enlargements due to kala-azar, to malaria, and so on. The group is raided from every side. What remains? Only the forms of 'splenic anæmia', the cause of which is unknown. Or, as Mayo wisely and wittily says, " Put in the form of an Hibernianism, incomplete knowledge is essential to the diagnosis. If we know the cause of splenic anæmia it is not splenic anæmia ". 'Banti's disease' and 'splenic anæmia' are therefore synonyms for the same condition, the former title indicating especially the later, the latter the earlier, stages.

Clinical History.—Splenic anæmia was defined by Osler as " an intoxication of unknown nature characterized by great chronicity, primary progressive enlargement of the spleen which cannot be correlated with any known cause, anæmia of a secondary type, with leukopenia, a marked tendency to hæmorrhage—particularly from the stomach,—and in many cases a terminal stage with cirrhosis of the liver and jaundice ". The clinical features of the disease then are the following :—

1. *A very chronic course*—in which the symptoms progressively and steadily increase in severity, without amendment, and without any hope of spontaneous recovery.

2. *A slowly progressive enlargement of the spleen.*—This is the first of all evidences of disease; the bulk of the organ undergoes an increase, at first apparently slight, but later more rapid. The ratio of increase probably remains unaltered throughout. The enlargement may finally be very considerable, though it is rare for the spleen to become as large as in myeloid leukæmia, or in some cases of Hodgkin's disease, or in malaria, or in Gaucher's disease. The spleen is not altered except in bulk, so far as physical examination shows: the surface is smooth, the notches apparent; there is no tenderness, nor is a friction rub felt or heard. It is said that a 'bruit de diable' has been heard (Sippy, Rolleston) " due to eddies produced by slight torsion of the dilated veins in the gastrosplenic omentum or of the splenic vein ". Seeing that clinical recognition of splenic enlargement is not possible until the spleen is at least double the normal size, it is more than probable that the inaugural and early symptoms of splenic anæmia are quite unrecognized.

3. *Changes in the blood* are of the type found in secondary anæmia. The red cells may drop to less than 2,000,000 per c.mm.; the average number is one-half of the normal. The colour-index is low. In a series of fifteen cases Osler found the number of red cells to be 3,425,000 per

* Krull, *Mitteil. a. d. Grenzgeb., d. Med. u. Chir.*, 1915, xxviii, 718.

c.mm. and the hæmoglobin 47 per cent. A recent hæmorrhage will of course affect the count very considerably; though it has often been observed that recovery after a hæmorrhage is rapid, and that within two or three weeks the blood-count may so improve as almost to reach the normal. The white cells are never above the normal unless there has been a recent hæmorrhage, or an inflammatory complication is developing. Leukopenia is the rule. In Osler's case the average count was 4520.

4. *The tendency to hæmorrhages* is remarkable. Hæmatemesis especially is seen, occasionally with copious melæna. Other forms of bleeding are also mentioned in recorded cases; epistaxis, purpura, and hæmaturia are the most commonly seen. The amount of blood lost, especially from the stomach, may be enormous. I have seen two cases in which the apparently pure blood vomited within a couple of hours measured over three pints. Osler records a case in which three quarts of blood were lost within thirty-six hours. Recurrence of the hæmorrhage is frequent. A remarkable case is related by Hutchison and Ledingham* of a woman who was admitted to the London Hospital on account of severe hæmatemesis no less than thirteen times within a period of fifteen years. The blood comes in such cases, it is believed, from œsophageal varices and dilated vasa brevia, both of which are found in a large proportion of the cases.

5. *Affection of the liver.*—In the later stages of the disease the liver enlarges, and presents the clinical pictures of Laennec's cirrhosis. Ascites is present with the hepatic enlargement, or in some cases without it. This terminal condition, in which the liver is enlarged and dropsy is present together with the earlier conditions described, is often spoken of as 'Banti's disease'; but if this latter term is retained it is perhaps wiser to use it only as a synonym of 'splenic anæmia'.

6. *An unknown causation.*—The discovery of a cause for the splenic condition removes the case from the category of splenic anæmia. As I have said, the term 'splenic anæmia' as originally used included a group of diseases characterized by certain clinical features common to them all. Upon this group encroachments have steadily been made, and may well continue to be made, as our knowledge of the etiology of special diseases becomes by degrees more accurate.

7. *Other phenomena of less importance* may briefly be enumerated. A general enlargement of lymph-glands is not present. Until the latest stage there is no alteration of the urinary function. Occasional attacks of heaviness in the epigastrium, flatulence, and indigestion are observed, which lead, when hæmorrhage occurs, to a diagnosis of 'gastric ulcer'. Such dyspepsias are less frequently seen than might be supposed. Rarely there may be slight pigmentation of the skin. If jaundice is present the case is not one of splenic anæmia.

The Differential Diagnosis.—This as a rule is not difficult. The mistake I have most commonly seen is the making of a diagnosis of *gastric* or *duodenal ulcer*. I have now seen five cases in which a patient suffering from splenic anæmia was referred to me as an example of these diseases. The absence of a clear history of dyspepsia, the presence of an easily palpable spleen, and the blood changes, soon revealed the true condition. The contrary mistake may be made. Rolleston relates the following case† :—

> "Some years ago a middle-aged man was under my care in St. George's Hospital. He was very anæmic, and with a history of recurrent hæmatemesis. There was a tumour which appeared to be an enlarged spleen, and the condition was regarded as splenic anæmia. The necropsy showed that the tumour was a large hydatid cyst in the left kidney, and that a chronic gastric ulcer was responsible for the repeated hæmatemesis."

In any doubtful case an *x*-ray examination would almost certainly clear away the uncertainty and demonstrate the presence of a chronic gastric ulcer.

Cirrhosis of the liver has occasionally presented difficulties in diagnosis. The number of cases in which the splenic enlargement is considerable, and the hepatic enlargement slight, must be excessively small. That the spleen may be much enlarged in cases of Laennec's cirrhosis is certain; and in such a condition a copious hæmatemesis might well raise a doubt as to the true diagnosis. Naunyn and others consider that splenic anæmia is merely a type of hepatic cirrhosis in which the liver changes are relatively slight, at least until the final stages are approaching. If a patient is first seen when the spleen is grossly enlarged, the liver cirrhotic, ascites abundant, hæmorrhages recurrent, and ill health and emaciation advanced, it is not certainly possible to say whether the case is one of advanced Laennec's cirrhosis, or is in the terminal stages of Banti's disease. The accurate diagnosis is, however, made without difficulty if the earlier stages of the disease are carefully sought.

Syphilitic enlargement of the spleen and liver may be associated with a moderate

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* Allbutt's *System of Medicine*, v, 759. † *Practitioner*, 1914, April, 480.

degree of anæmia. In such cases the symptoms of splenic anæmia are reproduced with remarkable accuracy. The differential diagnosis is achieved by a close study of the history, by a discovery of a positive Wassermann reaction, and by a recognition of the effects of antisyphilitic treatment. The latter, however, is not always successful. W. J. Mayo records five cases* in which he removed enlarged spleens in conditions of chronic intractable syphilis with severe anæmia, when the patient has been resistant to careful treatment for syphilis, carried out during a period of several months. After removal of the spleen the anæmia rapidly disappeared and the syphilis was cured with comparatively mild antiluetic treatment such as had previously failed to affect either the syphilitic condition or the spleen. Coupland records a case in which the spleen was removed for 'splenic anæmia' with much benefit; the patient died two years later, and syphilitic disease of the liver was found.†

Chronic obstruction of the splenic vein.—Many years ago Dock and Warthin‡ called attention to the occurrence of phlebitis and calcification in the splenic vein, in cases in which the group of symptoms and signs associated with splenic anæmia was present. Other changes in the splenic vein in similar cases have been recorded by various observers. These are summarized by Rolleston§ as follows:—

The splenic vein may be:

1. Reduced to a fibrous cord;
2. Represented only by a plexus of veins, as in a case in which hæmatemesis occurred at intervals of ten months for twenty years;‖
3. Thrombosed as the result of extensive endophlebitis.**
4. Occluded by an organized thrombus at its proximal end.††

These various morbid changes may be different stages of the same process, but the sequence of events may vary: thus endophlebitis may undoubtedly cause thrombosis, and it is quite possible that organization of a primary thrombosis may be followed by endophlebitis and calcification.‡‡

In cases such as these the differential diagnosis is impossible. The view that all cases of splenic anæmia are the result of changes such as these in the splenic or portal vein cannot be sustained. In some cases of splenectomy for splenic anæmia, it is true, these changes may be found, in greater or less degree, and at times they have been known to embarrass the operator by causing a difficulty with the ligation of the pedicle, and troublesome hæmorrhage. But in the great majority of instances no such changes are discoverable, though recently search has been carefully made for them.

The influence of trauma in exciting phlebitis and thrombosis in the splenic or portal vein must be remembered. Ledingham§§ writes that "many cases which showed symptoms of splenic anæmia or Banti's disease have presented a history of previous severe abdominal injury, and that thrombosis of the portal vein, with consequent splenomegaly, anæmia, and moderate cirrhosis of the liver, has been proved on several occasions to follow injury". A recent case in my own experience confirms this association of early and severe trauma with the symptom-complex of splenic anæmia.

Moschowitz, in an admirable summary and discussion of the subject of Banti's disease,‖‖ calls attention to the simulation of this disease by cases in which there is persistence of the umbilical vein. In recent years four such cases have been described in which the clinical symptoms were closely similar to, or identical with, those of Banti's syndrome. There was also a hypoplasia of the liver attributed to persistence of the vein, which on post-mortem examination was found enormously dilated in all cases, and communicated

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* *Trans. Amer. Surg. Assoc.* 1919, xxxvii, 483.
† *Brit. Med. Jour.*, 1896, i, 1445.
‡ *Amer. Jour. Med. Sci.*, 1904, cxxvii, 24.
§ *Practitioner*, 1914, xcii, 479.
‖ Langdon Brown, *St. Bart's. Hosp. Rep.*, 1901, xxxvii, 155.
** Oettinger et Fiessinger, *Rev. de Méd.*, 1907, xxvii, 1109, etc.
†† Bland-Sutton, *Proc. Roy. Soc. Med.*, 1913, vi, 239.
‡‡ Thompson and Turnbull, *Quart. Jour. Med.*, 1911, v, 291.
§§ Allbutt's *System of Medicine*, v, 759.
‖‖ *Jour. Amer. Med. Assoc.*, 1917, lxix, 1045.

in some with the deep hypogastric or deep epigastric veins. The unusual and excessive amount of blood carried in this vein caused a damming back of blood in the splenic vein, which in turn was responsible for the gigantic overgrowth of the spleen.

THE PATHOGENESIS OF BANTI'S DISEASE.—The fact of utmost significance in connection with the causation of this disease is that it is cured or arrested by removal of the spleen. This fact may be accounted for, either by assuming that the disease is primarily and essentially located in the spleen, or by assigning to the organ the rôle of modifying the action of some agent situated elsewhere in the body.

If the disease is primarily splenic, a search for a specific microbic infecting agent should ultimately be successful. Hitherto no convincing evidence of this has been found, although Hollins has argued strongly in favour of incriminating the colon bacillus. There is scope for further research in this direction; and the organ removed during life, if straightway examined, should provide profitable material for routine bacteriological investigation.

The enlargement of the spleen has been attributed to excessive hæmolytic activity by those who consider the disease to begin in some other part of the body. But such a view does not sufficiently explain the fibrosis which is the outstanding histological feature of the disease. A chronic infective process would account for the enlargement as well as the fibrosis, and accord better with the absence of undue hæmolysis of the red blood-cells. In splenic anæmia the red cells never show 'fragility'. If there is a change the corpuscles may show increased rather than diminished resistance.

The anæmia, in like manner, may be regarded as an incident, or as an essential part of the disease. Rolleston, a very distinguished authority, does not regard the anæmia as primary; he believes it to be secondary to attacks of very severe hæmorrhage, chiefly because he finds that regeneration of blood takes place after these events. This view, however, is, I think, subject to the criticism that such severe hæmorrhage is not invariable, and that the substance elaborated in the spleen need not be capable of affecting the bone-marrow until after it has left the liver, where it has undergone modification. Further, whatever the poisonous substance may be, it need not completely arrest blood-cell development. A parallel case is, I think, sometimes furnished by subjects of leukæmia in which an intercurrent infection supervenes, with a temporary restoration of the normal blood-picture.

Hollins regards the disease as being due to an active 'intoxication' produced by the colon bacillus, whose 'colilysin' brings about the anæmia, whilst its actual presence in both spleen and liver accounts for the fibrosis of each organ. This view would put every kind of cirrhosis of the liver on the same level, because 'colilysins' could not be expected to vary radically in their action. The facts would be better met were it suggested that the spleen harbours various organisms, some of which only excite a local fibrosis, others induce a simple cirrhosis of the liver, and still others produce that form of cirrhosis associated with Banti's disease, with a toxic anæmia and other specific symptoms.

In respect of the hæmorrhage which is so conspicuous and alarming a feature of some cases, Rolleston considers that the enormously distended vasa brevia rupture into the stomach as a result of the torsion of the splenic vein caused by the great bulk of the organ. This opinion is certainly correct in many cases. The hæmorrhage is so profuse and so swiftly escapes from the stomach that large vessels must be implicated. Such vessels as Rolleston describes are often seen in operations upon cases of splenic anæmia when abundant hæmatemesis has occurred. But this cannot, I think, be the whole explanation. The relationship between enlargement of the spleen and gastric hæmorrhage is cryptic, but certain; for, as Balfour was the first to show, removal of the spleen may cure a patient whose life has been jeopardized by severe and recurrent hæmorrhages from the stomach. Gastric hæmorrhage is known to be toxic in origin in certain cases, as for example those in which there is a lesion in the appendix, intestine, or gall-bladder; and those also in which the lesion lies in the spleen or liver, or both.

TREATMENT.—The only treatment for splenic anæmia is splenectomy. The appropriate moment for the removal of the organ is chosen. It is inadvisable to operate soon

after a grave hæmorrhage, or when the spleen is extremely large. In the latter case the effect of radium on the tumour should be tried; almost certainly it will cause a rapid and considerable shrinkage in the organ. If this should happily be the case, splenectomy is done when the spleen is at its smallest, and before it has begun to enlarge afresh, as it will certainly do after a few weeks. It is imperative to operate upon cases of this disease as early as possible. No other form of treatment needs consideration; the dangers and difficulties of the operation increase with the lapse of time; early operation means a more certain chance of recovery and a quicker convalescence. In the later stages the mortality of operation is higher, amounting to 25 per cent as compared with an average of about 10 per cent. In the terminal stages operation becomes so dangerous that only the inevitably fatal outcome of the unhealed disease justifies its performance.

The degree of improvement that may take place is astonishing, even in the late stages of the disease with advanced involvement of the liver. It is, as W. J. Mayo says, an evidence that the great power of the liver to regenerate its specific cells is utilized to the full.

The difficulties of the operation are greater in splenic anæmia than in any other disease. In almost all cases adhesions binding the organ especially to the under surface of the diaphragm are present. They may be numerous and exceedingly dense, and their separation may cause a copious and grave hæmorrhage. But they are never so dense nor so strong as to prevent the completion of the operation. The details of the operation in other respects are the same here as elsewhere. At the Mayo clinic up to Sept. 20, 1920, 73 operations had been performed, with 9 deaths, equal to 12·3 per cent. The after-results are excellent; the rather high operative mortality is due to the technical difficulties of the late cases, which, apart from operation, would all be fatal.

HÆMOLYTIC JAUNDICE.

(*See Fig.* 233.)

In his work, *Diseases of the Liver*, Murchison, a well of wisdom, describes cases of chronic slight jaundice occurring in several members of the same family: an association with splenic enlargement is not mentioned. Cases of congenital jaundice and splenomegaly occurring together were first recorded by Claude Wilson in 1890 and in 1893.* Hayem, in 1898, described 5 cases of icterus† similar in character to these, though acquired and not congenital, and presenting certain features in common. There were in all a slight chronic jaundice and normal stools and urine. The absence of such conditions as pale stools, mahogany-coloured urine, and tormenting itching of the skin was especially noted. The spleen in all was large and hard, and the liver a little increased in size. In all anæmia was present, the erythrocytes numbering between one and three millions; and in all there was a history of acute exacerbations. In none was there any family history of similar conditions; in three the first appearance of jaundice occurred in adult life.

In 1900 Minkowski described the occurrence of chronic jaundice in eight members of one family, extending over three generations; in these the symptoms and signs were similar to those described by Hayem, but in addition urobilin was noticed in the urine; there were pigment deposits in the kidney; there was enlargement of the spleen as the result of hypertrophy and vascular engorgement; there was no cirrhosis of the liver.

Two types of disease were thus recognized: the acquired form of Hayem, and the congenital or familial form of Wilson and Minkowski. The former type was more fully described, and its clinical history and blood condition more critically examined, by Widal. The latter type in respect of its hæmatology was especially studied by Chauffard, who first pointed out that the resistance of the red blood-cells to hypotonic salt solutions was greatly diminished. This increased 'fragility' constitutes the factor of chief importance in the disease. Of the two, the acquired form (the 'Hayem-Widal type') is the more serious, and apart from surgical treatment appears to be inevitably fatal.

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* *Trans. Clin. Soc.*, 1890, 162, and 1893, 165. † *Bull. et Mém. Soc. Méd. de Paris*, xxv, 122.

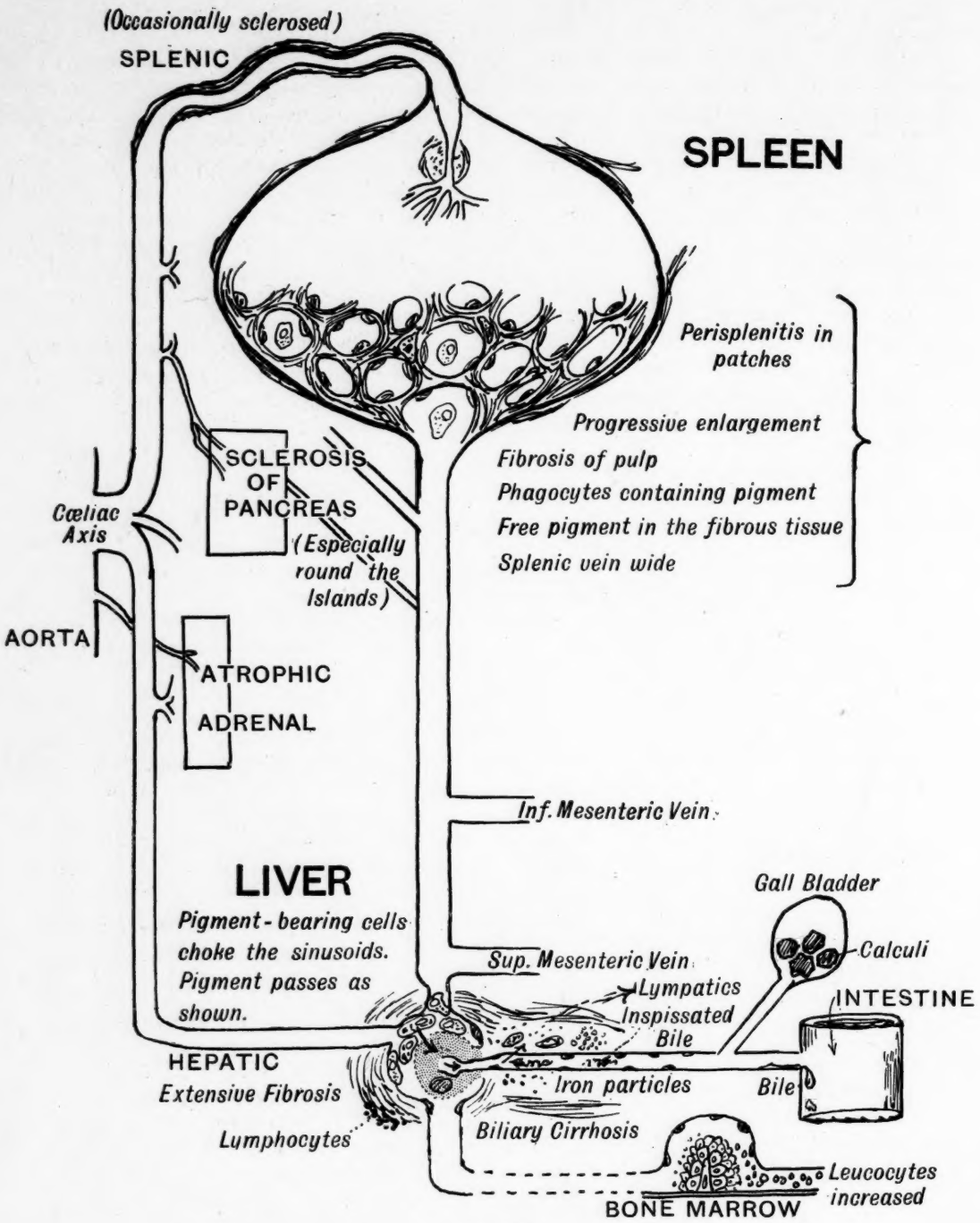

FIG. 233.

THE CHIEF CHANGES IN HÆMOLYTIC JAUNDICE.

THE SYMPTOMS in the two types are very similar. There are acholuric jaundice—that is, jaundice with unaltered stools and urine—enlargement of the spleen, and anæmia. There is no itching of the skin, and there is not that degree of rapid wasting so often seen in cases of obstruction to the common duct. The blood changes show a reduction in the number of red cells, an increased number of reticulated cells, and a lessened resistance to hypotonic salt solution. In two of the cases of the acquired type which I have seen, the symptoms have very closely resembled those of obstruction of the common duct by calculus. In both there were exacerbations of jaundice preceded and accompanied by fever, and by pain and tenderness in the epigastrium. In one of these my diagnosis would certainly have been confidently given as 'cholangitis due to calculus', but that a surgeon of great experience had explored the duct and discovered no stone. The diagnosis may be very difficult in cases in which gall-stones also are present. In about 60 per cent of recorded cases stones have been found in the gall-bladder or in the ducts at the time that operation for removal of the spleen was undertaken.

These acute exacerbations during the otherwise tranquil course of the disease were first described by Widal as 'crises of deglobulization'. They are acholuric crises and are due, it is supposed, to massive hæmolytic activity, an activity which Eppinger estimates as being competent to destroy the whole of the red blood-cells in the body within a period of twenty-four hours, with the result of throwing an immense strain upon all the organs of the body concerned in blood production. In these crises there are great malaise; an elevation of temperature to 101° or 102°, increase in the size of the spleen, which may become very tender; a deepening in the tinge of jaundice; acute anæmia, intense hæmolysis with, in the graver cases, a temporary hæmoglobinæmia; and urobilin is found in the urine. More rarely the liver also is enlarged, and the epigastrium is often tender. There is no itching of the skin, and there are no petechial hæmorrhages. It will be seen how close is the mimicry of the symptoms caused by a comparatively small gall-stone floating in a comparatively wide common duct; and remembrance must always be given to the fact that in so large a proportion of cases gall-stones, whether in the gall-bladder or in the common duct, are found at operation. The very worst forms of crises are probably often, if not always, due to impaction of calculi in the common duct, and the evidences of biliary obstruction in the urine and fæces may then be found. Elliott and Kanavel,* in an admirable paper, say that in the crises "one can always find evidence of excessive regeneration, i.e., polychromatophilia, nucleated red cells, and certain reticulated bodies in the red cells stained by vital stains as first recorded by Vaughan".

The distinction between the congenital and acquired forms is real. The congenital form is exceedingly chronic in its duration and quiescent in its manifestations. Chauffard said of patients suffering from this form, that they were 'more jaundiced than ill'. I have more than once been consulted by patients on account of other diseases (loose cartilage in the knee, and carcinoma of the breast) who were suffering from the congenital form of this disease; the jaundice was regarded with as little interest as the colour of the hair. In the familial type of the disease several observers have noted that the condition is of a graver type in the parent; the jaundice is deeper, the crises are severer and more frequent, and complications are more prone to develop. Not a few of the patients, affected though not afflicted by the disease, live their days out in comfort, and die, at advanced ages perhaps, of maladies unconnected with this condition. A few patients have lived to the age of 80, and one at least to the age of 90.

The acquired form may begin abruptly, and run an eager rapid course from the first. Anæmia quickly becomes profound, the red cells falling to one million within a few weeks. The crises of pain, temperature, and deepened jaundice are more frequent than in the congenital type. In one direction the disease, whether congenital or acquired (generally the latter), may wander away into the neighbourhood of pernicious anæmia. Chauffard describes an "icteric form of pernicious anæmia which, when accompanied by diminished

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* *Surg. Gynecol. and Obst.*, 1915, xxi, 21.

resistance and reticulated red cells, represents the least compensated form of hæmolytic icterus ". Weissenbach records a case of this type also.

PATHOGENESIS.—The older views that this disease is primarily hepatic in origin are for ever set aside by our surgical experiences ; for it is known beyond dispute that removal of the spleen 'cures' the patient, who, if the operation has been done in stages earlier than the terminal, remains entirely free from symptoms at all subsequent periods. The spleen, if not the exclusive cause or seat of the disease, exerts the profoundest influence upon its pathogeny.

Several views as to the ultimate causation have been held. Chauffard at first, and Widal later, believed the essential factor to be a dystrophy, an increased fragility of the red cells. This view is held by the great majority of those who have studied the question in recent years. Other authorities, led by Minkowski, hold the opinion that the primary change is an increased hæmolytic activity, probably restricted to the spleen. Widal, the most earnest supporter of the former view, considers that the red cells which are congenitally infirm are destroyed in the general circulation ; their remnants are taken up by the spleen, which undergoes enlargement, forming a tumour for which Ponfick introduced the term 'spodogenous', and also by the bone-marrow, kidney, and liver, all of which are found on post-mortem examination to be deeply pigmented. This opinion has lost ground since the many good results following splenectomy have been witnessed, though, as I shall mention, it does not appear from the very late examination of Sir Spencer Wells's case that the dystrophy of the red cells is always altered even after many years of perfect health following splenectomy. Consequently the altered character of the red cells may be sometimes evidence of faulty manufacture, their lipoid component being deficient, as I have already suggested. This does not nullify the opinion that the spleen has much to say in the subsequent treatment of such defective cells. In my own cases fragility of the red cells disappeared soon after splenectomy, and has not returned. The experience in Spencer Wells's case is, I think, exceptional.

Minkowski's view is held by a few later writers, including Banti, who consider that the spleen is not only enlarged as a consequence of the retention within it of cell remnants, but that within the spleen cells are prepared for destruction and are there actively destroyed. An examination of the spleens removed during life or obtained at autopsy shows no specific change. The deep congestion of the splenic pulp and of the sinusoids, constantly found, is common to many other forms of splenic disease. Occasionally biliary cirrhosis is found at autopsy.

TREATMENT.—Treatment of this condition is by no means always necessary. The symptoms may be very slight, or may even be absent. If crises occur they may be so infrequent and so speedily pass away that the patient, having suffered from them for years, may pay no serious heed to them. In cases rather more severe, general medical treatment and the use of radium therapy have proved to be valueless. Where the symptoms are troublesome to the patient, and especially so in the acquired form, recourse to operation should be had in as early a stage as possible. It is better not to operate in, or near, a time of crisis, and if the spleen is unduly large its size may be reduced temporarily by the application of radium. Splenectomy has proved to be a specific in this disease. Its dangers are slight ; in Kanavel's collection of 48 cases there were 2 deaths ; in Mayo's series of 32 cases there was 1 death. And the results are excellent. Within a few days the patient loses the tinge of jaundice entirely, all symptoms disappear, and there is never any recurrence. No operation in surgery gives such swift and striking results. It is very remarkable to witness the change in a patient who has been jaundiced for years or from birth ;. the skin becomes clear and white, sometimes within forty-eight hours. The first case submitted to operation was recorded by Sir Spencer Wells.* The patient was a young unmarried lady, age 22, who had an abdominal tumour " the size of a young child's head ". The tumour was below the umbilicus, central, elastic, but without fluctua-

* *Med. Chir. Trans.*, 1888, lxxi, 255.

tion. Its movements were closely associated with those of the uterus, and its lower border was felt behind and to the left of the uterus. Sir Spencer Wells was doubtful as to the precise seat and character of the tumour, but thought that it must be either uterine or ovarian. The patient's very florid complexion inclined him to the former view. Since the age of nine the patient had been subject to frequent attacks of jaundice, and the mother said the urine had "always been dark in colour". The operation was performed on Dec. 5, 1887, was followed by a good recovery, and six weeks later the patient's medical man wrote: "I question whether she has for many years past been six weeks without an icteric tinge". It is interesting to note that the patient was alive and well in the year 1914, and Lord Dawson then reported* "that the red cells still showed increased fragility". Two similar cases, in which the symptoms have been completely relieved by splenectomy but the increased fragility remains unchanged, are recorded by Kahr† and Roth, but, as I have remarked, this experience is probably unusual. The matter needs further inquiry.

The second case of hæmolytic jaundice to be treated surgically was operated upon, in 1895, by Bland-Sutton; the result was excellent, and the patient was reported alive and well five years later. Sir John Bland-Sutton tells me that he has not seen the patient for five years, but that she was then quite well. There can therefore be no hesitation in advising operation in all appropriate cases.

Giffin‡ reports that the result of the examination of patients in the Mayo clinic, by the method of Schneider, shows that the quantity of the bile pigments found in the duodenum, always in excess of the normal in this disease, steadily declines after removal of the spleen.

In all operations the condition of other abdominal organs will of course be examined as a part of the usual routine. The association in so many cases of cholelithiasis, and of a greatly-thickened bile, in stages earlier than those of calculous deposit, will involve the removal or the drainage of the gall-bladder, and possibly an exploration of the common bile-duct. No operation for hæmolytic jaundice is complete until the bile-passages have been thoroughly explored. The removal of the appendix will be performed in all cases in which the condition of the patient does not prohibit the very slight additional manipulation.

The results at the Mayo clinic up to Sept. 20, 1920, showed 32 cases with 1 death, a mortality of 3·2 per cent. Like all other statistics of this clinic they represent the results obtained by a group of men of the highest technical skill, working under conditions unsurpassed elsewhere. They show the level which highly organized surgical endeavours can attain, and are an example and an encouragement to all.

DIFFERENTIAL DIAGNOSIS.

The differential diagnosis of the several diseases I have now described is often a matter of grave difficulty. The table which follows on pages 358 and 359, adapted from Krumbhaar, presents the points of similarity and of difference in a form that can be quickly seen:—

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* *Proc. Roy. Soc. Med.* (Clin. Sect.) 1914, vii, 86. † *Verh. d. deut. Kong. f. inn. Med.*, 1913, xxx, 326.
‡ *Surg. Gynecol. and Obst.*, 1917, xxv, 152.

DIFFERENTIAL DIAGNOSIS OF CERTAI

DISEASE	ETIOLOGY	PATHOLOGY OF SPLEEN	FAMILY HISTORY	TIME OF ONSET	DURATION	ICTERUS	SPLENOMEGALY
Gaucher's disease	Toxin ? Infection ? Tumour ?	Peculiar cell hyperplasia	Occasionally positive	Childhood	Many years	Rare	+ + +
Splenic anæmia	Toxin ? Infection ?	Hyperplasia Fibrosis	Negative	Adult life	Few years	Rare	+
Acquired hæmolytic jaundice	1. Primary ? 2. Secondary to infection	Congestion and pigmentation	Negative	Any age	Many years	Present	+ +
Familial hæmolytic jaundice	Heredity	Congestion and pigmentation	Positive	Congenital or childhood	Many years	Present	+ +
Pernicious anæmia	Enterogenous toxin?	Fibrosis	Negative	Adult life	Few years, with remissions	Very rare	Slight or diminished

CONCLUSION.

It is evident that a consideration of the whole subject of diseases of the spleen must take a very wide view. A number of symptoms may direct attention to the spleen, even when clinical examination does not reveal the presence of splenomegaly. It is through the correct insight into the significance of the clinical symptoms and other morbid phenomena that the real understanding of any supposed case of splenic disease becomes possible. Instead of searching only for the existence of this or that splenic disease, *an inquiry should be directed to the determination of the functional capacity of all the various organs* likely to be deranged. The symptoms already named may be looked upon as evidence of some disorder in the particular *systems* now under consideration. This derangement must be regarded not merely as a restriction of the morbid changes to the spleen, but as a disturbance of wide ramification throughout the whole body, affecting one or other, or perhaps even all, of the four systems in which the spleen plays a part. The focus, at the moment, may in truth be in the pulp of the spleen ; but even so, the general picture presented by the patient is the outcome of the participation of the other systems in the process which started in the spleen. It may be that splenectomy in any of these diseases will remove the obvious culmination of the morbid process, and thus bring about a 'cure' of the disease or an arrest of its development ; but it does not by any means follow that all the other related parts are thereby caused to return to their normal states. Absence of symptoms does not imply the restitution of normal functions. The case of Sir Spencer Wells and Lord Dawson (*see* pp. 356, 357) discloses this truth unequivocally. In this case fragility of the red cells was found twenty-seven years after the removal of the spleen for hæmolytic jaundice.

A further step in the investigation of the clinical condition of the patient should aim at the exact discovery of the *site* of the lesion in certain particular cell-types : (*a*) In the spleen-pulp ; (*b*) In the bone-marrow and in any part where reticulo-endothelial cells may exist in specially congregated or active masses ; (*c*) In the liver ; (*d*) In the endocrine organs, including the pancreas. This lesion being predicted, or recognized, the question will arise as to whether it consists in, or entails, the elaboration of poisons capable of causing hæmolysis, cirrhosis, or asthenia.

The tissue affected, and the changes therein resulting being recognized, further research must be directed to the discovery of *the type of infective agent* at work, whether bacillary, spirochætal, or other. In other words, the patient is no longer to be regarded merely as

SPLENIC DISEASES (*after Krumbhaar*).

HÆMORRHAGES	ANÆMIA	RESISTANCE OF RED BLOOD-CELLS	RETICULATED RED BLOOD-CELLS	UROBILINURIA	LEUCOCYTES IN BLOOD	LIVER	TREATMENT
Occasionally	Slight	?	?	?	−	+	Splenectomy ?
Occasionally	Slight to severe	Normal	Normal	+	−	First + Later −	Splenectomy
Rare	Severe	Diminished	Increased	+	−	+ or normal	Splenectomy
None	Slight	Diminished	Increased	+	−	+	Splenectomy
Rare	Severe	Increased	Increased	+	− or +	Normal	Iron, arsenic, etc. (splenectomy and transfusion)

the victim of some type of 'disease', but as the victim of disorders of a certain character in certain parts of certain anatomical or functional systems of the body. It is the form of the disorder, the form of distribution (determined by an assessment of the functional capacity of the several organs concerned or likely to be concerned), which, when correctly studied, will inevitably lead to the source and cause of the morbid state, and ultimately to the prospect of the 'cure' of the patient.

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VISITS TO SURGICAL CLINICS AT HOME AND ABROAD.

MR. JAMES BERRY'S CLINIC AT THE ROYAL FREE HOSPITAL.

THE foundations of Mr. Berry's clinic at the Royal Free Hospital in the Gray's Inn Road were laid a good many years ago, for it is more than thirty years since Mr. Berry was first appointed to the surgical staff of the hospital.

These three decades have witnessed the gradual development of one of the most active and interesting surgical clinics in this country, whether considered from an educational or from a purely technical point of view. Mr. Berry has managed to preserve all that is best of the essentially British methods in the teaching of surgery, and to them has added a great deal of the cream of the Continental and American methods. This he has been able to do because of his extensive travels, which have enabled him to inspect the work of most of the famous surgical clinics of the world.

We cannot do better than describe what may be taken to be an average week in Mr. Berry's clinic at the Royal Free Hospital. Operations are done on Mondays, with Friday as a second day should it prove necessary. It is wise to be punctual, for the time announced, viz., 2.0 p.m., is very strictly adhered to. Mr. Berry makes a practice of beginning the operation itself at 2.0 and not merely preparing for it. The list of operations is generally formidable, running occasionally into a dozen, or even more. The theatre system, which is based largely on the ideals which Mr. Berry has himself evolved, is as follows:—There are two theatres. each with an anæsthetic room. These two theatres communicate through the intermediation of a sterilizing room, and when an operation is finished in one theatre the surgeon and his assistants walk through this communicating room to the adjoining theatre where all is in readiness for the next operation. Mr. Berry was one of the first to realize that it is necessary to have a trained team in order to effect the maximum saving of time. At the Royal Free Hospital he has generally two assistants, one senior with some years' experience of his methods, and one more junior corresponding to a house surgeon. In addition there are several dressers, each having a well-defined function in the team. One of the most important factors in the success of the work of this clinic is the anæsthesia, and Mr. Berry has been fortunate in having, in Dr. Dickinson Berry, an anæsthetist who is accustomed to his methods and who has worked with him for many years. A second anæsthetist is available, and helps very much in avoiding the irritating delays between operations which seem inevitable with a single anæsthetist.

Mr. Berry by no means confines himself to goitre and cleft-palate surgery. Attendance at the clinic will soon convince the visitor that, while thyroid surgery is seldom wanting, nearly every type of major operation can be seen from time to time.

The three following operations have been selected for description from a very large number which were seen.

1. *Ligation of superior thyroid artery for exophthalmic goitre.*—A digest of the case was given before the patient was brought into the theatre. A board is provided bearing an abstract of the notes of the case, and this may be drawn up to the gallery by anyone who may be interested to read them. Local anæsthesia is generally selected for this operation. A solution of novocain, 0·5 per cent, without adrenalin, was injected with a

powerful metal syringe at the level of the upper border of the thyroid cartilage; this line is usually indicated by the upper of two transverse creases at the upper part of the neck. After waiting about twenty minutes to allow the local anæsthetic to act, an incision was made in the line indicated, and deepened until the sternomastoid and omohyoid muscles were defined. The artery was found by a little careful blunt dissection between these two muscles, and was then tied in continuity with a single strand of 000 silk. No special attempt was made to include the veins or the whole of the upper pole. All vessels were ligated, the platysma was sewn up with a fine continuous catgut suture, and the skin united with a continuous suture of fine fishing-gut. No drainage is used for this type of case. The operation lasted about fifteen minutes.

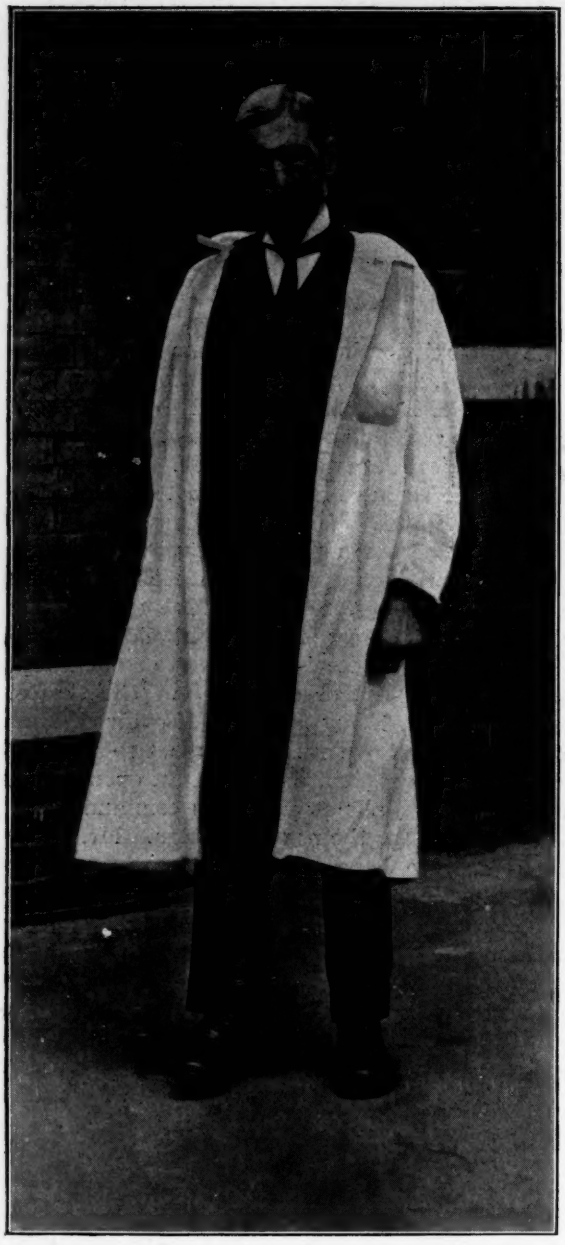


Fig. 234.—Mr. Berry in the quadrangle at the Royal Free Hospital.

2. *Resection extirpation of a large cystic adenoma of the right lobe of the thyroid.*—The patient, a woman, age 50, was brought into the theatre to be anæsthetized, as Mr. Berry considers it wise never to allow such cases to be anæsthetized in the anteroom. The dangerous period, where dyspnœa is severe, is during the induction, and should sudden asphyxia occur it will generally be possible to make a rapid incision and deliver the tumour in time to save the patient; but should this occur while the patient is in the anæsthetic room valuable time may be lost. The anæsthetic employed almost invariably for this type of case at Mr. Berry's clinic is open ether preceded by $\frac{1}{100}$ gr. of atropine, but without any other drug. The greatest care is exercised to maintain a very light anæsthesia, so that the minimum of ether is used; and indeed, during the later stages of the operation, the patient sometimes is able to answer questions quite sensibly, without however remembering anything at all about it afterwards. Special attention was given to the proper placing of the patient's head, and the anæsthetist was screened off carefully by a towel held by a dresser or nurse, in place of the wire screen which is sometimes used elsewhere, and which is so incommoding to the surgeon's elbow. A low transverse incision was employed and carried down through the platysma, and the flap so outlined was raised as far as the thyroid cartilage, all vessels being secured with the utmost care. Some large veins underlying the flap were next dissected out and secured with forceps. The

skin flaps were protected by means of flannelette secured to the edges with a special type of towel-forceps; the wound was held open with a most useful automatic self-retaining retractor.

The muscles were then separated in the mid-line of the neck, the infrahyoid group on the right were next cut through high up near their attachments, and a few small bleeding points in the cut surface of the muscles clamped with artery forceps. Mr. Berry explained the great importance of making sure that the correct layer was reached before separation of the gland was attempted, since failure to do so might land one in very serious difficulties. The middle thyroid vein was now defined and tied off by means of a special aneurysm needle, thus enabling the surgeon to introduce a finger behind the tumour and to dislocate it from its bed. It was noticed at once that the patient breathed more comfortably. The vessels supplying the tumour were now controlled by a series of artery forceps applied round its periphery as near to its attached base as was compatible with avoidance of damage to the recurrent laryngeal nerve, and the thinned-out layer of gland

Fig. 235.—In the wards.

substance which covered the tumour was incised just beyond these forceps down to the level of the capsule of the tumour proper. The posterior part of the adenoma was then separated by blunt dissection, a few more bleeding points were secured, and the whole mass, being now free, was removed, the time occupied up to this point being twenty minutes. The artery forceps were now replaced by ligatures of 000 silk tied with very great care, three half-knots being used in each case, and for the larger vessels the silk was used doubled. No vessels were twisted, as Mr. Berry explained how unsafe this would be. When all had been tied off the patient was made to strain by the anæsthetist (who had allowed the patient to come round partially), who gagged the mouth open and stimulated the back of the pharynx with a swab on a holder. This step tests the efficacy of the hæmostasis, and one bleeding vessel of considerable size was detected and secured. Mr. Berry explained that the one real danger of the operation was recurrent venous hæmorrhage, and that the step just described reduced the risk to a minimum.

The infrahyoid muscles were then united with a continuous suture of catgut, and a separate layer of fine catgut sutures was used to unite the platysma. A short paraffin-

coated glass tube was placed in the middle line and the skin united with a continuous suture of fine fishing-gut, leaving about half an inch at each end unsewn for drainage of the sub-platysmal space.

The operation, which had taken forty minutes, was completed by the application of a most efficient dressing, fixed by means of a bandage which prevents the patient moving the head for the first twenty-four hours. Mr. Berry mentioned that the tube would be removed the next day and that the patient would be allowed to sit out of bed for half an hour on the following day.

Fig. 236.—Operating for cleft palate.

3. *Operation for cleft palate.*—The patient, age 18 months, had a cleft which extended as far as the anterior palatine canal and was of moderate width. Mr. Berry explained that it was not necessary to wait until the child was three years' old, but that he treated each case on its merits ; the simpler cases could often be closed at twelve months or even earlier ; only the most difficult need be delayed until the third year.

The patient was anæsthetized with chloroform, and placed with the shoulders raised and the head extended so as to allow blood to collect in the roof of the pharynx, where it was less likely to prove a danger. A Smith's gag was used, held by a trained dresser. The mucoperiosteal flap was raised, beginning from the cleft and working outwards. The first incision was made with a special right-angled knife, and the flap raised mainly by means of an aneurysm needle which Mr. Berry considers a very useful type of periosteal elevator

for such cases. The next step, the detachment of the soft palate from the hard, was done very thoroughly by means of curved scissors, one blade thrust under the posterior end of the mucoperiosteal flap, and between it and the bone, the other blade on the nasal aspect of the soft palate. This completed, it was then seen that the cleft could be closed without any lateral incisions. The edges of the cleft were now pared, a fine shaving being removed anteriorly, and rather more from the soft palate. A special angled cleft-palate needle of Mr. Berry's own pattern was now used for inserting a mattress stitch of thick silkworm-gut through the soft palate. This stitch is intended as a tension stitch, and is tied over short pieces of rubber tubing. The edges of the soft palate were now brought into exact apposition by means of fine sutures of silkworm-gut which were continued to the very end of the uvula. The hard palate was closed by mattress sutures placed so as to evert the edges and bring broad surfaces of mucoperiosteum into apposition. Mr. Berry explained that the sutures would be left for a fortnight—except, of course, the deep tension suture which is generally removed about the fifth to the seventh day—and that it is wiser to leave them even longer if any sign of breaking down of the line of union should be noticed.

On Wednesdays, at 1.30, consultations are held at the Royal Free Hospital. Mr. Berry's energy and enthusiasm are responsible for the inauguration and maintenance of this most interesting feature of the work of the hospital. Cases are shown by members of the Honorary Staff, medical and surgical, and are examined by all members of the staff present. The patient is then removed, and the case discussed by the staff in order of seniority. At 2.0 p.m. Mr. Berry goes round his wards with his dressers and visitors. He makes a great feature of bedside teaching, and dwells particularly on the essentially practical details of the cases; students are encouraged to examine and handle the cases themselves. The cases operated on the previous Monday are seen, and the notes relating to them read and criticized.

On Fridays, at 1.15, Mr. Berry gives a most valuable clinical lecture, utilizing specimens removed at operation, museum preparations, pictures, and the epidiascope (which he generously presented to the hospital) to illustrate his remarks. The field covered is a wide one, and while avoiding any purely academic teaching, Mr. Berry emphasizes all that is necessary to give the student a complete picture of the diseases with which he deals. At 2.0 p.m. the wards are again visited and the cases to be operated on the following Monday are examined and selected, and the work of the week ends at about 4.0 p.m.

Anyone who has seen much of the work of Mr. Berry at this clinic must come away with the impression of having been in an atmosphere of serious surgery, without any taint of the faddy and ephemeral. The organization of the clinic is as near perfection as possible, and the results are such as would be expected where no effort is spared by all concerned to safeguard the patient's interests from the first to the last.

A CASE OF ASCITES DUE TO A CHRONIC INTUSSUSCEPTION OF SEVERAL MONTHS' DURATION.

By F. M. SPENCER, London.

This case seems worthy of note, in view of the following outstanding features: (1) The age of the patient—a boy of 7½ years; (2) The chronicity of the disease—the first symptoms directly referable to his trouble occurring four months before his parents sought medical advice; (3) The physical signs presented on examination, the most prominent being a tumour situated in the epigastrium, associated with an extreme degree of ascites, and obstructive symptoms; (4) The marked wasting present, with intermittent abdominal pains and occasional vomiting, associated with regularity and even frequency of the bowels.

R. N., age 7½, boy. When first seen, in March, 1920, the child had been complaining of abdominal pains and sickness on and off for four months. The pains at first occurred at intervals of a week or fortnight, but latterly they were more frequent, until they became of almost daily occurrence. They were described as "stabbing like a knife", and were always referred to the umbilicus; they came in spasms, lasted a few minutes, and gradually eased off. At first, each attack was accompanied by vomiting, but later there was no vomiting and only occasionally nausea and retching. The bowels tended to be constipated at first, but were kept open by purgatives, and latterly moved freely of themselves. The mother stated that the stools contained blood on three occasions at the outset of the trouble—once bright red, and twice just sufficient to streak the stools. She also said that the boy "got a lump across his navel" during the attacks of pain, and gurgling sounds were often present. The appetite was good, but wasting was very extreme. He had had no chest symptoms; was not known to be feverish; and had no bladder or kidney symptoms. Previous and family history both good. No trace of tuberculosis on either side of the family.

He had attended the out-patient department of the Hospital for Sick Children, Great Ormond Street, since March 2, 1920, where he had been treated for 'abdominal tuberulosis'. He was admitted as an in-patient on April 16, under the care of Mr. George Waugh, on account of partial obstruction and the increase of the ascites.

On Admission.—The boy was extremely wasted, with thin loose skin, but in no immediate discomfort. Temperature normal. Pulse rapid, 100 per minute, but otherwise respiratory and cardiovascular systems normal. The abdomen was distended, of even contour, and showing free respiratory movements; circumference round umbilicus 22 inches; tenderness in epigastrium, and some guarding of the muscles on deep pressure. An indefinite mass could be made out, running diagonally across the epigastrium, reaching almost from loin to loin. Free fluid in considerable quantity demonstrated, shifting dullness and fluid thrill both being present.

A provisional diagnosis was made of tuberculous peritonitis with ascites and obstructive symptoms. Laparotomy was deferred with the object of getting the child into a state more fit for operation.

During the next few days the child seemed to improve somewhat, but still had attacks of abdominal pain at intervals, resembling cramp in character, and accompanied by nausea, but no vomiting. The bowels moved normally twice daily; no tenesmus; no blood or mucus in stools, which were light in colour and rather loose. On April 22, the sixth day after admission, the patient had a very severe attack of pain, during which coils of distended bowel were seen to rise up under the thin abdominal wall in the right iliac region, and disappear with a gurgle. This attack lasted about a quarter of an hour,

and left the child collapsed and worn. The circumference of the abdomen was now 23 inches at the navel—an increase of 1 inch in six days. A similar attack occurred on April 24, when it was decided that a laparotomy should be done. The usual means were taken to combat the shock, and salines were given to enable him to stand an operation.

OPERATION.—The abdomen was opened six hours later by Mr. George Waugh under open ether. Several pints of serosanguineous fluid escaped on opening the peritoneum, with no smell, and resembling rather the fluid found in connection with malignant abdominal tumours. Some thick lymph was mopped away from the pelvis. The peritoneum showed little more than vascular engorgement; no roughness and no signs of tuberculosis anywhere. In the upper abdomen a large, firm, and rigidly fixed tumour was found closely bound down by omentum, stretching from one kidney region to the other, and apparently retroperitoneal. The patient's condition did not warrant further examination, and the abdomen was closed.

Examination of the fluid showed: Specific gravity, 1008; albumin, 2·4 per cent; reaction amphoteric. A film showed pus-cells containing bacilli and Gram-negative diplococci; cultures grew streptococci and a few colonies of *Bacillus coli*.

The child seemed to pick up after the operation; but about twenty-four hours later he had several attacks of severe abdominal pain, and became very collapsed, with thin rapid pulse and sighing respirations, and thirty-six hours after operation he died.

It is of particular interest to note that at no time during his eight days' stay in hospital had there been any change in the size, shape, or position of the tumour, so that his bowels were acting regularly with the intussusception permanently present.

FIG. 237.—Photograph showing size of intussusception, hole eroded in the 'sheath', and œdematous intussusceptum. The whole is shown in the position in which it lay in the abdomen. Caput with terminal aperture of intussusceptum was at point X, and consisted of terminal part of ileum with lowest portion of ascending colon.

POST-MORTEM.—A general peritonitis was found, with thick, purulent fluid, and a strong smell of *B. coli communis* infection. Adjacent coils of gut were covered and bound together by plastic lymph.

The tumour was found to be an intussusception, with transverse colon as a sheath and containing ascending colon and several feet of small intestine (*Fig.* 237). About the centre of the sheath was a hole, through which protruded the engorged and congested mucous membrane of the entering layer. The actual hole measured about 2 by 2½ inches, but the wall of the gut in the neighbourhood of the ulceration was very thin, consisting merely of serosa for an area an inch or so wide. It seems probable that the great size of the head of the intussusceptum, from engorgement and œdema, had thus caused a pressure necrosis of the containing sheath and acted as a ball-valve, and thus prevented leakage in any amount sufficient to cause acute peritoneal symptoms. Therefore the fluid present would be a general peritoneal exudate caused by gradual infection through the damaged bowel wall, and at the time of operation this 'protecting valve' was displaced, allowing a free exit of intestinal contents, which led to rapid and severe general peritonitis.

CASE OF GASTROJEJUNOCOLIC FISTULA WITH STERCORACEOUS VOMITING, FOLLOWING GASTRO-ENTEROSTOMY.

By JOHN MARNOCH, Aberdeen.

E. P. E., male, age 37, married, was of excellent physique and enjoyed unimpaired health until early in 1907, when he began to have vague discomfort in his right lower abdomen. This was variously thought to be due to appendicitis, duodenal ulcer, or some renal trouble. He was passed fit for colonial service, and left for East Africa in the same year. During his residence there he had frequent attacks of discomfort and was sometimes sick, but had no treatment. In 1913 the character of his trouble changed, and he now began to have pain in the pit of his stomach, which appeared at regular intervals after meals. In the beginning of 1914 he had five attacks of what was diagnosed appendicitis, and he was sent home for operation in July of the same year. Laparotomy was performed the following August and a diseased appendix removed, but he stated that it was impossible to explore the rest of his abdomen as he took the anæsthetic badly. In November of the same year he had another attack of his epigastric pain, which continued at intervals to bother him, and resisted medical treatment until April, 1915, when he underwent an operation for duodenal ulcer, the ulcer being invaginated and a posterior gastro-enterostomy performed. This gave him relief, apparently for a few weeks only, when he began to suffer from pain all over his abdomen, and loss of appetite. Up until 1917 he continued in ill-health, having frequent attacks of pain, referred mainly to his left upper abdomen. Latterly he had been troubled with constipation, and as this was thought to be the main cause of his condition, he underwent treatment for it, with decided improvement, and during 1918, although he was better than he had been for some years, he described himself as 'nothing very grand'. About Christmas of this year he began to suffer from what he called gastritis, the symptoms being pain, increasing in severity until he vomited, after which he got relief. The vomitus was often brown in colour, but it is uncertain whether it contained blood. Under treatment he improved considerably, and in November of the same year went back to East Africa, where he remained well until April, 1920. He now developed diarrhœa, and on May 9 he vomited stercoraceous material, which was repeated at varying intervals until October 9.

At this point he was seen by me at Duff House in consultation with Dr. Spriggs, where he had been for a short time under treatment. The following is an excerpt of Dr. Spriggs' notes of the case :—

Examination.—Height 6 ft. 3 in., weight (in dressing gown), 10 st. 8¾ lb. Cardiovascular, blood, and nervous systems normal ; Tongue clean, with small patches of denuded epithelium near the tip. Teeth adequate. Abdomen : Slight fullness in left hypochondrium ; no tenderness or rigidity.

Gastric Contents.—Test breakfast : Free HCl present ; Total acidity 67 ; Metallic chlorides 0·16 per cent ; Active chlorides 0·26 per cent, i.e., slightly hyperacid. Vomit : Acid, brick-coloured mass with fæcal odour.

X-ray Examination.—Abdominal opacities negative. Stomach contracted 2 inches above stoma through which material rushes during ingestion ; emptied in 2½ hours. Pylorus not seen normally filled. No ileal stasis. Cæcum and colon dilated, and expel contents rapidly. Barium enema : Rectum and sigmoid normally filled ; rest of colon irregularly segmented. No material was seen to enter the colon from the stomach, or vice versa.

Fæces.—Liquid or pultaceous clay-coloured motions ; 3 to 6 in twenty-four hours ; total weight 700 to 1200 grms. ; many fatty-acid crystals and some undigested meat fragments. Culture : *B. coli* only ; no protozoa.

Urine.—Nil abnormal.

RESULT OF ANALYSIS OF URINE AND FÆCES DURING 3 DAYS, AUG. 10, 11, AND 12, 1920, ON DIET A. 3.
Total weight before drying—4350 grms. Water 94·0 per cent.

	Nitrogen	Carbohydrate	Fat
Actual weight per diem in food ..	14·42	190·1	108·3
„ „ „ „ fæces ..	1·98	—	33·2
Percentage in dried fæces	2·3	trace	38·0
Percentage absorbed	—	100	69·3

Of the total fat, 38·1 per cent was neutral, 47·3 per cent fatty acids, and 14·6 per cent soaps.

Nitrogen in food		14·42 grms.
„ „ urine ..	13·53 grms.	
„ „ fæces ..	1·90 „	15·43 „
i.e., a minus balance of		1·01 „

Diastatic value of urine 45 (normal 10 to 20). Tryptic value of fæces 10 (normal 25), fæces very dilute.

A provisional diagnosis of sprue complicated by the regurgitation of fæcal material into the stomach, had been made, but treatment for the condition had proved unsatisfactory. That there was some communication between the intestine and the stomach other than that of the gastro-enterostomy was clear from the following facts: during the attacks of fæcal vomiting the vomitus was indistinguishable from what came per anum; moreover, between attacks he was constantly having foul eructations; and lastly, when an attempt had been made to wash out his colon, he vomited part of the fluid injected. The most likely explanation of the condition was the formation of a gastrocolic fistula, and operation was recommended.

Operation.—On the morning of operation his stomach was washed out, but the whole of the fluid was not returned. He informed the nurse that on previous occasions when he had washed out his stomach he had had a similar experience, and that when the fluid was not all returned, it made his bowels move. On opening the abdomen and examining the site of the posterior gastro-enterostomy, the jejunum was found adherent to the under surface of the transverse colon immediately adjacent to the site of the stoma. The latter was ample and well placed. The jejunum was separated from the stomach and colon, and it was found that the gastro-enterostomy opening in the stomach lay side-by-side with an opening the size of a two-shilling piece in the colon, and that both these communicated with a common opening in the jejunum. As the pylorus was not contracted, and there was now no trace of duodenal ulcer, the gastric, colic, and jejunal openings were closed separately. A very noticeable feature was the dilatation of the jejunum for a considerable distance below the site of the anastomosis. It was almost as large as the colon.

He made an uneventful recovery, and in due course returned to Duff House. On Nov. 19 Dr. Spriggs reports the result of the absorption test on a three days' measured diet, as follows: "It shows that 96 per cent of his fat was absorbed and on nitrogen balance in the three days put on 3·5 grammes N; so that these figures are normal. The acidity of the stomach was raised. A test breakfast gave an acidity of 86, with active chlorides 0·21 per cent—this is a little on the high side". On Nov. 29 the patient reports that he weighs well over 12 stones, and that although he has been suffering a little from hyperacidity, he is gradually getting better from it.

Remarks.—The development of the peptic ulcer, which was jejunal in type, took place probably within the first two years after gastro-enterostomy was performed, in all likelihood when he began to locate his pain in the left upper abdomen. That the hyperacidity had a causal relation to it seems clear, although I am told that an unabsorbable suture had been employed; no trace of it could be discovered at the operation. The onset of diarrhœa in April, 1920, followed in May by stercoraceous vomiting, settles without much doubt the date of perforation. As regards the future, treatment must be directed towards reducing the hyperacidity.

INSTRUCTIVE MISTAKES.

GALL-STONE WITH PERFORATIVE CHOLECYSTITIS SIMULATING ACUTE APPENDICITIS.

THE patient, a soldier, age 18, was admitted to a base hospital in France complaining of abdominal pain and vomiting. He said that he had been in another base hospital six weeks before with appendicitis. No operation was done, and he remained in hospital for ten days, subsequently going to a convalescent camp and his base depôt, having again become ill twenty-four hours before admission.

ON ADMISSION his temperature was 103°; pulse 120; tongue dry and furred. His abdomen moved badly on respiration. There was tenderness and great rigidity in the right iliac fossa, but the upper half of the right rectus muscle was also somewhat tender and rigid, though less so than the lower half. Signs of free fluid were obtained in both flanks.

The patient complained of pain on micturition, and was tender per rectum high up on the right. A diagnosis of acute appendicitis with peritonitis was made, and the abdomen was opened by a right rectus incision. The appendix was found to be normal in appearance except for a little superficial redness which it shared with the neighbouring viscera. Free colourless fluid was found in the peritoneal cavity. On further examination a lump was felt in the region of the gall-bladder. The incision was extended upwards, and after separating the omentum which enveloped it, a thick-walled gall-bladder, containing one large stone in the neck, was found, with a perforation about half-way down the fundus. The gall-bladder and stone were removed. Cultures from the free fluid and contents of the gall-bladder gave a pure growth of *B. paratyphosus B.* The patient made an uneventful recovery.

On reviewing the symptoms, the only ones which were not quite in accordance with the diagnosis made were the tenderness and rigidity of the upper part of the rectus, and the temperature, which was rather high for appendicitis. The patient stated that previous to his first admission to hospital he had never had a day's illness. A leucocyte count was not made.

GALL-STONES AND ACUTE PANCREATITIS SIMULATING PERFORATED GASTRIC ULCER.

A WOMAN, age 44, was admitted to hospital with the history that, two days before, she was seized with sudden acute pain in the upper part of the abdomen. During the two days she had vomited at frequent intervals dark-yellow watery vomit. She was constipated, and had passed one black stool since the onset of the pain. She had suffered with 'indigestion' for years.

ON ADMISSION her temperature was 100°; pulse 88; respirations 52. No abnormal signs in chest. Abdomen generally tender, of 'board-like' rigidity, especially in epigastrium; did not move on respiration. Liver dullness present; shifting dullness in flanks. Complained during examination of intermittent 'colicky' pains, and especially of pain in the small of the back.

Laparotomy was performed. Free fluid, pale yellow in colour, was at once seen.

The great omentum and mesocolon were œdematous and bile-stained. One small lobule of fat in the omentum showed fat necrosis. The head and about one inch of the body of the pancreas formed a hard mass three times the size of the normal gland. The gall-bladder was distended with bile and contained twenty-seven gall-stones. These were removed together with the gall-bladder; the pancreas was incised and a drainage tube inserted down to it. After mopping out the abdominal cavity, the abdomen was closed.

The urine, which was drawn off by catheter at the end of the operation, contained bile; sugar was absent, but 200 units of diastase were present. The urine next day contained 100 units of diastase and a little sugar; three weeks later the diastase had fallen to 10 units, and no sugar was found. Loewe's adrenalin test at no time caused mydriasis. No cyanosis was observed at any time.

On reviewing the symptoms, the persistent pain in the back, the abdominal rigidity for forty-eight hours after the onset of 'perforation', the undiminished liver dullness, and the pulse of 88 after the same lapse of time, are points against the diagnosis of perforated gastric ulcer. An examination of the urine would probably have given the clue. As it was, the patient was caught in the pre-hæmorrhagic stage of acute pancreatitis and made a perfect recovery.

AN OVARIAN CYST DIAGNOSED AS A NEW GROWTH OF THE COLON.

A WOMAN, age 52, complained of constipation, pain, and swelling of the abdomen. Neither abdominal, vaginal, nor rectal examination revealed anything. A provisional diagnosis of a pelvic tumour was abandoned, because the pelvis was empty and the normal uterus could be felt. The presence of a little blood on the examining finger in the rectum suggested a carcinoma of the descending colon. An exploratory laparotomy was advised and refused. Three months later the woman presented herself again on account of increasing abdominal pain, swelling, and constipation; and now three ill-defined lumpy swellings could be felt towards the upper part of the abdomen; the bowels were constipated, and only relieved by enemata. There had been no signs of rectal bleeding and no loss of weight.

The diagnosis made was carcinoma of some part of the colon, with secondary deposits in the mesentery and omentum, and commencing intestinal obstruction.

Laparotomy was advised with the idea of relieving impending intestinal obstruction by short-circuit. On opening the abdomen a large multilocular ovarian cyst with a long stretched-out pedicle was found. The cyst lay high up in the abdomen, and was adherent to coils of intestine. The cyst was removed, and recovery was uninterrupted.

SHORT NOTES OF RARE OR OBSCURE CASES.

PERFORATION OF THE URETER BY CALCULUS: EXTRAVASATION OF URINE: DEATH FROM URÆMIA AND SEPSIS.

By JAMES BERRY, London.

James P., age 21, carman, was first seen by me at the Royal Free Hospital on the evening of March 13, 1919, on account of a painful swelling of the right iliac fossa. For the previous nine weeks he had had a dull aching pain on the right side of the abdomen, and on the morning of March 12 he noticed a lump in the right groin. A few hours later he was seized with severe pain in the same region, and he vomited once. In the evening he was brought to the hospital and admitted. In the right inguinal region was a small soft swelling which was supposed to be a hernia; it was easily reduced shortly after admission, and the case was not thought to require any immediate operative interference. Temperature 99·6°, pulse 80, respirations 24. There was some rigidity and tenderness over the whole of the right side of the abdomen. An examination of the rectum was made, and it was reported that nothing abnormal could be felt. The urine was clear and acid, and said to contain no abnormal constituents. The patient was drowsy and unable to give a very clear account of his symptoms.

On the following day he seemed worse, the abdomen became distended, and the rigidity and tenderness on the right side increased. Temperature 100°, pulse 102. At 6 p.m., when I saw him, he was obviously very ill. There was no evidence of any hernia, but there was an ill-defined fullness in the right iliac fossa, without any marked tenderness on pressure; there was considerable general abdominal swelling, and definite rigidity of the right rectus. There was also some dullness in the iliac fossæ and hypogastrium. It was noticeable that the patient was thin and undersized, and looked much more like a boy of 15 or 16 than a man of 21.

No definite diagnosis could be made, but the patient was sent at once to the theatre, and the right iliac fossa explored through an oblique incision. On opening the peritoneal cavity a pint or more of clear, colourless, and odourless free fluid escaped. The appendix, intestines, and gall-bladder were all found to be normal. The right kidney was felt to be enlarged and flabby. It was then noticed that there was some swelling of the retroperitoneal tissue in the right iliac fossa, and in this swelling, near the brim of the pelvis, a small hard body could be felt. The patient was then put in the Trendelenburg position, an incision was made into the retroperitoneal tissues, and the hard body, which proved to be a calculus lying close to the ureter, was removed. In the right ureter, at the brim of the pelvis, was a ragged hole about half an inch in length, through which the calculus had evidently escaped. The ureter itself was much dilated and thickened; a probe was passed downwards into the bladder, and no other stone was felt. The œdema of the retroperitoneal tissue in the iliac fossa was clearly due to extravasated urine. As it was obviously impossible to sew up the ragged opening in the ureter, one end of a small rubber tube was placed in it, and the other end brought out through the abdominal wound, a second tube being placed in the abdominal cavity for drainage.

Subsequent Progress.—The peritoneal drain was removed on the day after the operation, the ureteric drain on the seventh day. The average daily amount of urine passed,

partly through the tube and partly per urethram, was between 3½ and 4½ pints. The specific gravity varied from 1008 to 1010, and there was nearly always a trace of albumin and a good deal of pus, and sometimes a little blood. For about a week the patient seemed to be doing fairly well ; then he began to get more and more drowsy, and he finally died of uræmia and sepsis on April 6, twenty-four days after the operation.

Post-mortem Examination.—This brought to light the condition shown in the accompanying drawing (*Fig.* 238), namely, double suppurative pyelonephrosis, with much destruction of the renal tissue. A second and much larger calculus was found impacted in the lower end of the left ureter. Both ureters, but especially the left, were greatly dilated, and the cellular tissue in the right iliac fossa and round the lower end of the right ureter was in a state of diffuse suppuration. The lungs showed bronchopneumonia. There

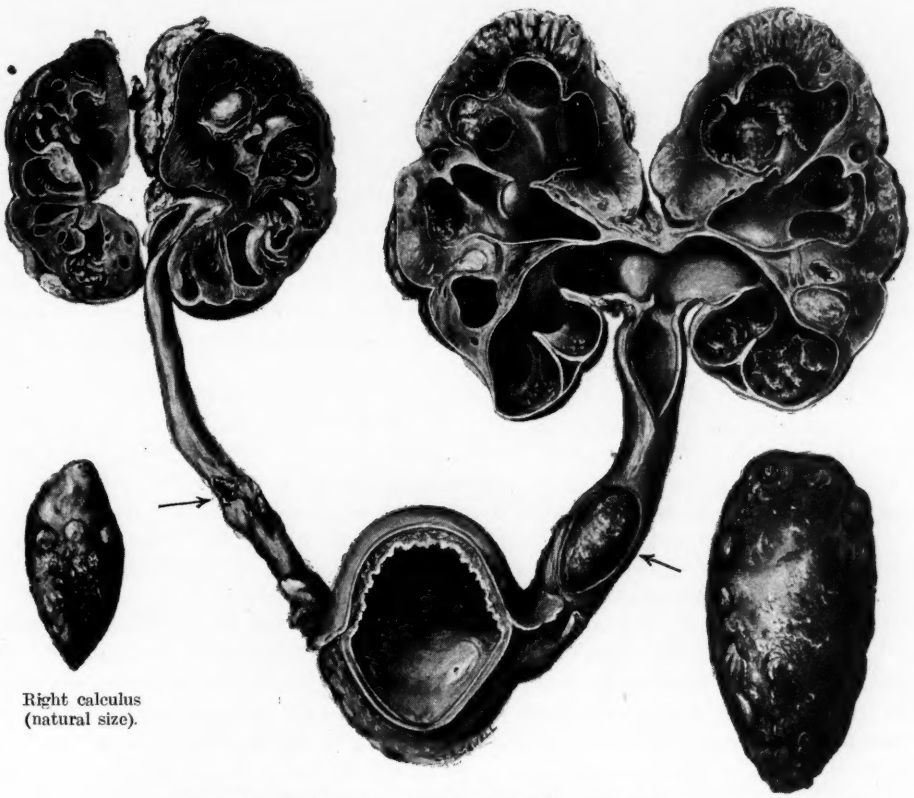


FIG. 238.—Double suppurating pyelonephrosis (⅓ scale).

was no peritonitis. The stones and urinary organs are now in the Royal Free Hospital Museum.

Remarks.—It is evident that both stones must have been lying quietly in the ureters for many years without causing any marked symptoms, although gradual and extensive destruction of the kidney tissue had been produced by pressure atrophy. The perforation of the right ureter and consequent extravasation of urine took place presumably on the day preceding the operation, when acute pain was first noticed.

It is to be regretted that no *x*-ray examination was made at any time. Had this been done years ago, the true nature of the case would have been revealed, and an operation for the removal of the stones, before the kidneys became distended and atrophied, would have been a comparatively easy affair, and would doubtless have saved the patient's life.

It is probable that before the operation the stone was only partially extruded from the ureter, and that the complete extrusion occurred only during the manipulations at the time of operation.

Finally, there can be but little doubt that the ill-development and juvenility of the patient was associated with the long-continued and progressive atrophy of the kidneys.

PAPILLOMA OF THE BLADDER OF UNUSUAL SIZE.

By JAMES BERRY, London.

George P., age 34, ironmonger's assistant, married, was sent to me at the Royal Free Hospital on Jan. 19, 1914, by Dr. Giuseppi, of Felixstowe, with the diagnosis of papilloma of the bladder. For eighteen months the patient had had gradually increasing intermittent hæmaturia, and recently micturition had become frequent and painful. He was a thin, pale man, but otherwise healthy. Cystoscopic examination showed a typical villous papilloma near the orifice of the *left* ureter, and washing of the bladder yielded small pieces of soft growth which confirmed the diagnosis. On Jan. 26, 1914, the bladder was opened suprapubically, and the growth, which was about as large as a walnut, was freely removed with scissors, together with its narrow pedicle and its base, the wound in the mucous membrane being sewn up with catgut. *The rest of the bladder was examined for other papillomata, but none were found.* The upper part of the cystotomy wound was closed with catgut sutures; the lower part was drained with a rubber tube for four days. Recovery was uneventful, and the patient returned to his home in the country on Feb. 21, the wound being soundly healed. He was advised to return if further hæmorrhage should occur.

For three years he remained quite well, and then began to have a recurrence of the hæmaturia, at first at intervals of about four to six weeks. In July, 1919, micturition began to be painful, and eventually his symptoms became so severe that in October he again consulted Dr. Giuseppi, who sent him back to me at once.

On admission, Oct. 22, he was in a miserable condition, passing water about every twenty minutes during the daytime and several times at night. The urine, which was faintly alkaline, and of sp. gr. 1015, contained blood and triple phosphates. The hæmaturia prevented any satisfactory examination with a cystoscope.

After a few days' preliminary treatment to diminish the alkalinity of the urine, the bladder was opened a second time on Oct. 27, and was found to be practically filled with soft papillomatous growth. This was rapidly pulled out of the bladder, partly with fingers and partly with scoop, until the bladder was nearly empty and the pedicle could be seen. This was about as thick as a little finger and sprang from the *right* side of the fundus of the bladder near the posterior wall, at a point about 1½ in. behind and above the right ureteric orifice. The pedicle was drawn forward, and its base, including some of the muscular wall of the bladder, excised freely with scissors. The wound thus made was sewn up with deep interrupted catgut sutures. A careful examination of the interior of the bladder showed that there were no other papillomata anywhere. The site of the previous papilloma was quite free from recurrence. The cystotomy wound was treated, as before, by partial suture and drainage for a few days. The patient again made a rapid recovery, and left the hospital nineteen days after the operation, quite well, and with the wound soundly healed.

About seven months later he came up again to report that he was quite well and had had no return of his symptoms.

Pathological Report.—The tumour removed at the second operation weighed 8¼ oz., and proved to be a simple villous papilloma of the usual type, springing from a single slender pedicle (*Fig.* 239). Microscopic sections, both of the tumour itself and of the portion of excised bladder wall, were made by Dr. Mary Schofield, Assistant Pathologist to the Royal Free Hospital, and show no evidence of malignancy.

Prof. Shattock has been good enough also to examine the sections with me, and has sent the following note: "Microscopic sections, carried through the tumour so as to include its slender pedicle, show that it is a simple villous papilloma, constructed of fine and highly vascular branching processes covered with transitional epithelium. The 'core' of the growth at the site of the pedicle consists of common connective tissue abundantly supplied with vessels, and includes a certain amount of unstriped muscle. The size and compactness of the bundles at the actual line of division indicates that here they represent portions of the proper muscular wall of the bladder; but beyond this the bundles become very slender and widely scattered in the connective tissue of the deeper portions of the processes, and may here be referred to the muscularis mucosæ."

FIG. 239.—Villous papilloma of the bladder, weighing 8¼ oz.

The tumour and microscopic section are now in the Museum of the Royal College of Surgeons.

Remarks. — The chief points of interest about the case are the very large size of the second tumour, and the fact that it is known to have grown to this size in a period of not more than five and a half years at the outside. The next largest innocent papilloma of the bladder which I have seen is in St. Thomas's Hospital Museum, and weighs 4 oz., which is less than half the weight of this one.

A CASE OF TONSILLAR CALCULUS OF UNUSUAL SIZE.

By G. S. WOODMAN, Kirkuk, Mesopotamia.

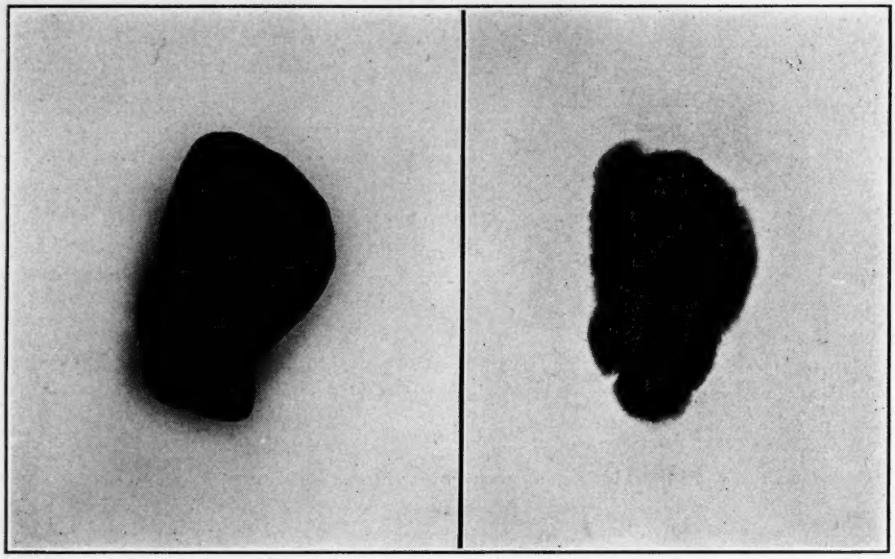
THE somewhat rare occurrence of large calculi in the tonsils has induced me to publish the notes of the following case which I saw at Kirkuk, in Northern Mesopotamia.

A. B., an ex-Turkish official, age 64, came to see me in 1919, complaining of the presence of 'a stone in his mouth' which caused difficulty in swallowing. He gave the following history. Thirteen years ago he had a stone about the size of a large pea in the right side of his throat, accompanied by an abscess in the upper part of the right side of his neck. The latter burst spontaneously, and the resultant sinus healed after removal of the stone per os. About three years ago a painless swelling appeared in the same site as the abscess referred to. This he poulticed with dried Smyrna figs; pus formed, and the swelling was incised by a German doctor in Stamboul. The wound took a long time to heal, and has since frequently broken down and discharged a small

quantity of thin sero-pus. The patient also stated that he imagined liquids escaped from the sinus on swallowing.

On examination, a stone was seen lying between the pillars of the fauces on the right side and firmly gripped by them, presenting an exposed surface about the size of a sixpence. Externally, in the upper part of the right anterior triangle of the neck, there was a small sinus which admitted the probe to the extent of a quarter of an inch. The stone could not be felt with the probe, and there was no evidence of any septic focus in the mouth or throat.

I extracted the stone with bullet forceps, considerable force being required. During removal the anterior pillar of the fauces was torn, the calculus being much broader at its centre than at the presenting surface. The accompanying illustrations (*Figs.* 240, 241), which are three-quarters natural size, show this point The weight of the calculus (which



FIGS. 240, 241.—Tonsillar calculus (¾ natural size), with skiagram.

is now in the Museum of the University of Durham College of Medicine) was 3½ drachms. Professor P. Phillips Bedson, who kindly examined it, reports that it is composed of phosphates and carbonates of lime, which accounts for its extreme opacity to *x* rays.

My opportunities of access to records of similar cases are limited. Bryant[1] reported a case of "calculus from the tonsil of the size of a small nut, spontaneously ejected", which he considered the result of calcification of a tuberculous deposit, around which suppuration had occurred, leading to its ejection. The specimen under notice would appear to be the result of long-continued suppuration.

Since my return to Kirkuk I have examined the late owner of the stone, and find that the old sinus in the neck has remained healed; there is nothing abnormal to be noticed in his fauces; a palpable thickening of the deep tissues is all that remains.

I wish to thank the Secretary for Health to the Civil Commissioner in Mesopotamia for permission to publish these notes.

REFERENCE.

[1] *Lancet*, 1860, ii.

A CONGENITAL ABNORMALITY OF THE FEMALE GENITO-URINARY ORGANS.

By HAROLD BURROWS, Southsea.

The following case of congenital defect has some features which seem to render it worthy of record :—Miss B., a girl of 21, had become engaged to be married. She was sent to me by Dr. Mabel Ross, because she had never menstruated and it was thought that perhaps an operation might put things right. The patient was a healthy, bright, attractive-looking girl, and perfectly feminine.

On examination the mammæ and external genitalia were found to be normal in appearance ; there was, however, no vaginal opening, nor did a rectal examination detect the presence of either a vagina or a cervix uteri ; there seemed to be but a thin partition between the rectum and the bladder. On abdominal palpation a rounded swelling was found occupying the left half of the pelvis, to the wall of which it was fixed. The girl had felt no pain in this lump, nor had she experienced any menstrual molimina. I thought the lump probably was a hæmatometra which had become adherent to the wall of the pelvis through some inflammatory process ; and with this view I advised her to have an operation done, to which she consented.

Operation.—A short transverse incision was made in the perineum, and the bladder was separated from the rectum for as great a distance as was possible through this route, but no trace of a vagina or a cervix uteri could be found. The wound was closed, and the abdomen was then opened by a median subumbilical incision, when the following abnormalities were discovered :—

There was a total absence of the vagina, uterus, broad ligament, right Fallopian tube, right ovary, and right kidney (no search was made for the right ureter). In the left loin was a very small kidney, but it did not feel like an active one ; in fact it seemed to be merely vestigial. Attached to the left brim of the pelvis was a sessile, cylindrical ovary which was clearly functioning. A Fallopian tube was present, and appeared to be normal at its fimbriated end where it was close to the ovary, but the tube itself dwindled away and disappeared at the upper pole of the pelvic lump which had been felt on abdominal palpation previous to the operation. The tube was closely applied to the peritoneum over this lump, and had no mesentery.

The pelvic tumour was next examined, and was found to be extraperitoneal. The peritoneum was incised over the swelling, and was easily stripped away from it. The swelling itself was roughly globular in shape and slightly lobulated, its substance having the appearance of that of a healthy kidney. A small portion was removed for microscopical examination, and was later found to consist of normal renal tissue. The bladder, rectum, and other viscera revealed no abnormality. No further examinations were made, though a cystoscopic inspection would have been of interest.

The case is not easy of interpretation. For if we assume that the right Wolffian body had failed to develop, it is difficult to explain either the presence of the two kidneys on the left side, or the atrophic condition of the left kidney. And if on the other hand we suppose that some abnormal gubernacular action or other mechanism had pulled the whole right Wolffian apparatus down into the left side of the pelvis, why should there be no discoverable trace of a uterus or vagina ?

Interesting features are the perfect mental and bodily health of the patient, and the retention in a complete degree of the feminine characteristics.

TWO CASES OF INTESTINAL OBSTRUCTION DUE TO AN ENTEROLITH; WITH REPORTS OF THE CHEMICAL ANALYSIS.

By JAMES PHILLIPS, Bradford.

On Jan. 22, 1920, I saw with Dr. Jenkins, of Shipley, a woman, age 65, who, after two or three months of increasing constipation, had been seized with rather severe abdominal pain four days previously, and who, when I saw her, was vomiting what was described as fæcal-smelling fluid. There had been no proper action of the bowels for four days. The same evening I opened the abdomen at the Bradford Royal Infirmary, and at once came on stinking pus. Near the cæcum I felt a hard body in a coil of bowel, and on delivering the latter saw that it was ileum near its lower end, and that the mesentery was gangrenous, with foul intestinal contents oozing from the gangrenous patches. I put a Paul's tube into the delivered coil of bowel and drained the abdomen, but the patient was desperately ill, and died thirty hours later.

The stone, which was removed, was rather larger than a big walnut, and I diagnosed the case as one of obstruction by gall-stone. But, post mortem, the R.S.O., Mr. Stewart, examined the abdomen and found that the gall-bladder was free and apparently normal. I then cut across the stone and found that it was formed of concentric layers of cocoa-brown material of the consistence of a gall-stone but gritty on section, and that its core consisted of a plum-stone.

Mr. Richardson, the Bradford City Analyst, kindly made a chemical analysis of the stone, of which the following is a summary :—

Moisture	2·6	per cent
Ash	less than 0·1	per cent (calcium compounds)
Analysis of dry organic matter :—		
Carbon	71·17	per cent
Hydrogen	10·87	,,
Nitrogen	0·29	,,
Sulphur	0·39	,,
Oxygen	17·26	,,

The probable presence of taurocholic acid, $C_{26}H_{45}O_7NS$, would account for the presence of nitrogen and sulphur. The concretion was sparingly soluble in hot benzene, but more soluble in a mixture of equal parts benzene and alcohol. The portion soluble in the alcohol and benzene mixture contained free acids which were estimated by titration. By saponification with alcoholic potash the fatty complex was found to consist of oxy-fatty-acid esters and anhydrides. A small amount of unsaponifiable substance melting at 99° C. was also obtained. The purified oxy-fatty acid melted at about 102° C. A rough outline analysis of the concretion would be as follows :—

Oxy-fatty acids	free	25·3	per cent
	as glycerides	14·0	,,
	as anhydrides	28·0	,,
Unsaponifiable substance		3·0	,,
Taurocholic acid		6·0	,,
Hyperoxidized insoluble matter		23·6	,,
Mineral matter		0·1	,,
		100·0	

On May 12, 1920, I saw with Dr. Viret a woman, age 68, who had suffered from abdominal pain, vomiting, and obstinate constipation for four weeks. There had not been complete obstruction of the bowels, and there had been days when there was very little pain or vomiting; but she had been able to keep little or nothing on her stomach, had lost much weight and strength, and had slept little. The vomit was described as "mostly bile-coloured and having a very nasty taste". There were no localizing signs and no distention. I opened her abdomen on the same evening and felt a foreign body which, when delivered, was found to lie in a coil of small gut—

apparently about the middle of the jejunum. It was removed by enterotomy and the abdomen closed; but the patient died without recovering consciousness.

The stone was of similar size and shape to the other, of rather lighter colour, of similar consistence but of looser texture, so that the layers crumbled when an attempt was made to section it.

Professor Raper, of Leeds University, kindly examined it for me. He tells me he has not been able to find any similar case recorded, and he proposes shortly to publish a fuller account of the examination of the enterolith in the *Biochemical Journal*; appended is a summary of his report:—

The weight of calculus as received was 6·8 grms. It was friable in texture and of a sandy colour, but had no definite nucleus. On grinding to powder, two small flat pieces of tissue resembling fruit-skin were obtained; otherwise it appeared to be homogeneous in structure.

By extraction with solvents three main fractions were separated: (1) Fatty substances, consisting of free fatty acids, neutral fat, and cholesterin, etc. This formed 16·4 per cent of the whole. (2) Unconjugated bile acids, almost wholly choleic acid. This formed 7·25 per cent of the whole. (3) This was insoluble in water and ordinary organic solvents, and consisted of food residues, bile pigment, etc. It formed 8·4 per cent of the whole.

Two-thirds of fraction (1) consisted of free fatty acids with an iodine value of 45·8. From fraction (2) choleic acid was obtained practically pure by one recrystallization. A small amount of an acid resembling dioxycholic acid was obtained from the mother liquors.

The mere trace of cholesterin found indicates that the calculus was not formed in the gall-bladder, and this is supported by the fact that the bile acid in the calculus was choleic and not glycocholeic acid. The latter has been found in human bile, but not the former. The reason for the deposition of choleic acid in the intestine is obscure, but the great insolubility of this acid compared with cholalic acid probably accounts for the presence of one only, and that the more insoluble one.

Remarks.—The chief interest of these two cases lies in the evidence they offer of the probability that in some of the cases described as 'intestinal obstruction by gall-stones' the cause of the obstruction may have been an enterolith.

I have seen in the last twenty years perhaps eight to ten such cases: in all of them the obstructing body was of size and shape similar to the two enteroliths above described —which I need hardly say is not the usual size of a gall-stone. In my first case it was only Mr. Stewart's discovery that the gall-bladder appeared normal which led me to divide the stone, and even then, had its nucleus not been so obvious a thing as a plum-stone, its appearance was sufficiently like a gall-stone to make it doubtful whether it would have occurred to me to have it analyzed. In the second case there was a nucleus of two small pieces—probably of fruit skin—but these only became apparent when the stone had been ground to powder.

In Moynihan's text-book on gall-stones (p. 253) is the description of a case by Lynn-Thomas. A man had died of intestinal obstruction. No operation had been performed. "The stone is remarkable as being conico-cylindrical in shape, like a pom-pom shell; it is $1\frac{5}{8}$ in. in diameter, and its point had travelled in front. *There were no adhesions around the gall-bladder and bile-duct.*" In other words, the stone was presumed to be a gall-stone from its naked-eye appearance.

My suggestion is that in such cases chemical analysis of the stones should be made; my feeling is that not a few stones which look like gall-stones would be found to be enteroliths. Professor Raper will be very glad to examine any specimens which may be sent to him.

REVIEWS AND NOTICES OF BOOKS.

Surgery, a Text-book by Various Authors. Edited by GEORGE E. GASK, C.M.G., D.S.O., F.R.C.S. and HAROLD W. WILSON, M.S., M.B., F.R.C.S. Roy. 8vo. Pp. xviii + 1232, with 39 plates (20 in colour) and 467 other illustrations. 1920. London: J. & A. Churchill. 42s. net.

THIS book, which is the evolutionary descendant of other text-books emanating from St. Bartholomew's Hospital, viz., Walsham's and then Spencer and Gask's Surgeries, is a notable addition to our surgical literature; this not so much on account of its good arrangement or its very beautiful illustrations, but because it represents the teaching of a single school of men who form the working team of one of our most ancient hospitals. Every member of the surgical staff and of all the special surgical departments of 'Bart's' has contributed to this volume. By this means, the advantages of getting articles by many authors and of preserving nevertheless a unity of conception and principles are both secured.

The main object of the book is a presentation of the practice, rather than the theory, of surgery, and this object is admirably fulfilled in the text, though it is to be noted that the illustrations in the main deal with pathology rather than with treatment of surgical disease. The practice of surgery described is that actually followed in the wards and out-patient clinics of St. Bartholomew's Hospital, and references to other surgical teaching are necessarily much curtailed. The inclusion of the whole practice of surgery in a single volume has necessitated articles on the eye, ear, nose, throat, and female genital organs, some of which are not complete enough even for the student's purpose, whilst the sections dealing with general surgery are shorter than their importance demands. The omission of a section on anæsthetics is unfortunate, and we are given the impression that the methods of local, spinal, intratracheal, or gas-and-oxygen anæsthesia hold no place in the practice of the hospital.

The descriptive illustrations of diseases and of diseased tissues form one of the most striking features of the work, the majority of the specimens presented being from the museum of the hospital. This pre-eminence of the pathological aspect of surgical teaching is very appropriate in a work emanating from the school to which Paget belonged.

In the matter of surgical methods of treatment the book is conspicuously moderate, even at the risk of being old-fashioned. This is seen, for example, in the section on fractures, and also in that on abdominal surgery. In fracture treatment open operation is relegated to such a subordinate place that no idea of methods or technique is obtained. Both in the fractured femur and in Pott's fracture, immobilization of the joints is taught as the routine method. In the treatment of hernias trusses play a very conspicuous part, even in such cases as irreducible femoral hernia. The radical operation for femoral hernia makes no mention of the part played by the conjoined tendon. In the section dealing with the stomach, excision of the ulcer-bearing area is not considered in relation to pyloric ulcers; and when partial gastrectomy is described for pyloric cancer, the suture of the whole open end of the proximal portion of the stomach into the jejunum finds no place.

The Early History of Surgery in Great Britain: its Organization and Development. By GEORGE PARKER, M.A., M.D., M.R.C.S. 8vo. Pp. ix + 204. Illustrated. 1920. London: A. & C. Black, Ltd. 7s. 6d. net.

THE history of their art has never appealed very much to surgeons. Ostensibly because they are more inclined to look forward than backward, or because they are too busy to trouble about the past; in reality because the majority are deficient in general education and have never made a study of the liberal arts and sciences. In this respect the Hunterian tradition is not yet dead, though he and his followers would have saved themselves a world of trouble and some bad mistakes had they known of the work done by their predecessors. The fault was not wholly theirs, for few books have been devoted wholly to the history of surgery, whilst those which existed were not always easy of access, were somewhat dull, and were often written in a language not understanded of the people. This excuse will no longer suffice. Dr. George Parker has written a primer of the history of surgery which is accurate, cheap, and interesting. He states modestly

that this volume is only an instalment of an inquiry into the ancient therapeutic gilds of this country—a subject upon which he is already a recognized authority. It is to be hoped, therefore, that Dr. Parker will continue to publish his results from time to time and not wait to issue them as a whole.

In the present work he begins his story about the year A.D. 1000, and ends it at 1850. It is remarkable how often aseptic methods were adopted by some of the greater surgeons who succeeded in obtaining union by first intention as a result of simple dressings and cleanliness. In every case their successors, and often their own pupils, fell back upon the salve surgery of Galen, until at last it became an axiom that every wound must suppurate before it could be healed *secundum artem*. Equally remarkable was the diagnostic and operative skill of these early surgeons, who would bring to a successful issue such operations as the suture of nerves, the repair of wounded bowel, and the removal of deeply-seated foreign bodies. As early as 1180 the Priory of Buckland Brewer, in Somerset, was devoted to the use of ladies and serving sisters of the Order of St. John of Jerusalem or the Knight Templars—says Dr. Parker—and this may be looked upon as the first training-school for nurses in England. Alluding to the English surgeons of this period, Dr. Parker might have given some of the facts which are known about Thomas de Weseham—the King's surgeon—which redeem him from the shadows of time which have enveloped all his contemporaries. Amongst other things, he was fortunate in obtaining a die which allowed him to mint his own money, and some silver pennies from his mint were found at Bruges a few years ago.

Dr. Parker gives an admirable account of the organization of surgery in England before 1540, and in London after 1540, and arrives at a remarkable generalization when he says, "There is some reason to think that Henry VIII, before he became involved in matrimonial troubles and ecclesiastical reforms, projected a complete reorganization both of medicine and surgery, and actually succeeded in carrying out a large part of his scheme". The hypothesis is fascinating, and it would be interesting to discover to what extent the King was the motive power behind Butts, Ferris, Vicary, and Harman. The growth of surgery in England after the Tudor period was very slow for nearly a century, and Dr. Parker states that it was no quicker abroad. But in the eighteenth century began the great revival of hospitals throughout the country that was the first sign of the coming humanitarian and social movement which is only just now expending itself—at any rate in the voluntary support of hospitals. Dr. Parker traces the rise of the hospitals and their schools, and also chronicles the failure of the gild authority, not only in London but throughout the kingdom. He concludes his survey with a tribute to the work done by the German and Viennese schools in the nineteenth century.

The book is illustrated with well-chosen and well-executed reproductions from various sources. There is a good index, and a most useful series of dates of the chief events in the history of surgery in the United Kingdom.

Orthopedic and Reconstructive Surgery, Industrial and Civilian. By FRED H. ALBEE, A.B., M.D., Sc.D., F.A.C.S., etc. Large 8vo. Pp. 1138, with 804 illustrations, including many coloured plates. 1919. Philadelphia and London: W. B. Saunders Co. £2 10s. net.

THIS important volume represents the author's well-known views on the subject of bone-grafting as applied to the whole realm of orthopædic and reconstructive surgery. Carefully written, profusely illustrated, and published according to Messrs. Saunders' high standard, it contains a very great wealth of material, and although probably no one will agree with all of its recommendations, yet there is no subject in which valuable and original contribution is not made to our knowledge of the technique and resources of bone surgery.

The chief value of the book consists in its presentations of new methods of treatment by means of bone-grafting. Its chief drawback is that the more conservative methods of treatment are described inadequately. This is seen most notably in the section dealing with tuberculous spine, in which disease the author holds that bone-grafting should be applied to all cases in which pain or muscle spasm demand it. He considers that the presence of septicæmia or a local pyogenic infection are the only contra-indications to its employment. Results in 532 cases of Pott's spinal disease treated by bone-grafting are given, and in these it is claimed that in 84 per cent the disease was arrested. No attempt is made to compare with these cases others treated by purely conservative measures.

In the treatment of many simple injuries the author allows himself to be carried away by his enthusiasm for his own inlay methods to such an extent that he describes most unnecessarily complex procedures. For example, a fracture of the patella is treated by the inlay of an I-shaped piece of the tibia, and a fracture of the ulna by a sliding graft which his own pictures show to be very inefficient (*Figs.* 364, 367).

However, these are small points, whereas the amount of valuable and original suggestion throughout the whole book is very great. The full lists of original papers at the end of each chapter go far to make up for the deficiency in description of the usually accepted methods of treatment.

Injuries of the Peripheral Nerves. By HENRY S. SOUTTAR, C.B.E., F.R.C.S. and EDWARD W. TWINING, M.R.C.S. Large 8vo. Fully illustrated. Pp. xii + 152. 1920. Bristol: John Wright & Sons Ltd. 18s. 6d. net.

PERHAPS no branch of the reconstructive surgery of the war has evoked so much enthusiasm amongst the workers in this field as the surgery of peripheral nerve injuries. In the short, concise monograph of Mr. Henry Souttar and Mr. Edward Twining the enthusiastic note is uppermost, and the authors have succeeded in conveying it to the reader. This book would appear to have been designed essentially for the guidance of the student or young surgeon, rather than as a thesis for consideration by experts, as it is written in a somewhat dogmatic fashion, and contains little or no discussion on controversial matters. The views put forward are personal ones, and are founded on a period of special experience in this type of war injury.

In discussing the pathology of nerve injuries, the authors insist on the primary nature of the injury in the majority of cases, and they consider that scar contraction or the growth of callus is rarely if ever responsible for the actual nerve lesion. Due homage is paid to the well-established work on the internal anatomy of nerve-trunks and its relationship to the mechanics of suture and regeneration; but the dictum that one-third of any nerve-trunk can be divided without producing permanent injury is quoted and emphasized without realizing that an adherence to this faith is incompatible with a strict conception of nerve topography.

In the section dealing with the operative repair of nerve injuries, some of the details of technique and procedure recommended cannot be passed without criticism. The writers advise that, in performing nerve suture, the cut ends are to be pressed firmly together by means of a tightly-drawn tension suture. It has been shown conclusively that this manœuvre is an abuse of the otherwise harmless tension suture, is provocative of intraneural scar tissue in its track, and moreover is directly antagonistic to the occurrence of rapid and accurate regeneration. For complete lesions with extensive gaps, the authors duly emphasize the comparative ease with which most of these gaps can be bridged after extensive freeing of nerve-trunks combined with displacement. They do not condemn the use of free nerve-grafts in a whole-hearted fashion, as they consider that recoveries have been seen after the use of autogenous grafts. In this connexion it is unfortunate that no authorities are quoted, nor are any reports of successful cases included.

For true irreparable lesions the writers advocate bone shortening (in the upper limb only), the bulb-flap operation, or nerve anastomosis. All these procedures are illustrated, and constitute the sole illustrations dealing with the actual operative repair of nerve lesions. They are thus accorded a place of honour, and will inevitably acquire a certain degree of prestige as legitimate operations. We feel there is no justification either for their inclusion or condonation in an authoritative work.

The chapter dealing with the surgical anatomy of the individual nerves and the methods of exposure is excellent. For adequate exploration of the brachial plexus, division of the clavicle is considered to be necessary as a routine; this advice will be subscribed to by all surgeons who have had experience in this field.

The pre-operative preparation of the limb, and the post-operative treatment by the various standardized methods of physiotherapy, are dealt with in a convincing and lucid way. The authors do not include the end-results of the peripheral nerve operations carried out in their own services, but a résumé of the type of result to be expected in each particular nerve is presented. In discussing alternative operations for the restoration of function where direct nerve repair is impracticable or has failed, the common error of recommending a position of nearly 90° abduction in arthrodesis of the shoulder-joint is made. Ankylosis of the shoulder-joint in this degree of abduction is of course applicable only in the case of children. Further, the operation of choice for producing stability of the ankle-joint is not arthrodesis, but tendon fixation.

This book, with its attractive style and its marginally-placed headings of the various sections in each chapter, is singularly easy to read. From a teaching standpoint it is a valuable contribution to the subject of peripheral nerve injuries, but the dogmatic exposition of the methods of operative repair detracts from what is otherwise a well-balanced essay.

Chirurgie Réparatrice et Orthopédique. By E. JEANBRAU (Montpellier), P. NOVÉ-JOSSERAND (Lyon), L. OMBRÉDANNE (Paris), and P. DESFOSSES (Paris). Large 8vo. Two volumes. Pp. 1340, with 1040 figures. 1920. Paris: Masson & Cie. 80 fr.

THIS work, in which forty-eight eminent French surgeons have collaborated, is a careful presentation of surgical practice such as may be demanded by the accidents and emergencies of civil life. It represents all the surgical lessons learned from the late war, but, instead of being merely a war surgery of retrospective interest, it is a practical application of lessons learned in the war to the kindred problems of peace.

The possibilities of surgical reconstruction after various injuries, the late functional results of the same, and the most suitable appliances which may be used to supplement or replace lost tissues or members, are the main objects of this work. The first part deals with general principles

both of surgical reconstruction and of the construction of apparatus. The second part shows the special application of these principles in the various regions of the body affected by injury—the head, neck, thorax, abdomen, and spine, as well as the limbs.

The work forms an invaluable book of reference, especially in regard to the construction of various types of apparatus which will assist in the restoration of function where full surgical repair is not possible.

The After-treatment of Surgical Patients. By WILLARD BARTLETT, A.M., M.D., F.A.C.S., and Collaborators. Large 8vo, in two volumes. Vol. I, pp. xxii + 674; Vol. II, pp. xvi + 391; with 435 illustrations. 1920. London: Henry Kimpton. £3 net.

THE author is one of the well-known and devoted band of American surgeons who, by their energy, have forced the attention of all British workers in similar fields to their meticulous and accurate investigations into those complications of surgical procedures, such for example as 'shock' (investigated by Crile), which have received comparatively scant attention elsewhere.

In these volumes the author has omitted the consideration of surgical procedures except in regard to certain minor operations such as blood transfusion, which is very fully dealt with. Surgical after-treatment has been considered as "beginning when the last suture is tied, and as lasting until the patient is restored to normal health".

The author advocates and carries out in his own clinic a 'follow-up' system which involves a correspondence with his patient for at least one year, and in certain kinds of cases, e.g., malignant, for many years. It is to be regretted that British surgeons are in the main so backward in this very important branch of after-treatment.

Vol. I deals with general subjects, Vol. II with measures of after-treatment as applied to operations on various organs. The author claims, and rightly, that works on general surgery give only scant attention to after-treatment.

Dr. Willard Bartlett has been remarkably fortunate in his choice of collaborators. The work of Dr. O. F. McKittrick on anæsthesia, pain, thirst, nausea and vomiting, etc., is particularly good, and much of it of real value. Dr. McKittrick's monographs on acid intoxication, diabetes in surgery, nephritis, etc., post-operative pneumonia, thrombophlebitis, and hæmophilia should be read by every surgeon. Dr. Ewerhardt contributes, amongst other chapters full of interest, those on exercise and massage, and hydrotherapy. A very excellent chapter is that on the post-operative treatment by radium and Röntgen rays in malignancy, by Russell H. Boggs.

Dr. Willard Bartlett on dry mouth, ether conjunctivitis, painful tongue, sore throat, etc., brings out many new theories as to their causation, and many hints, little known in this country, for their treatment. The author also deals in most lucid chapters with shock, hæmorrhage, post-operative ileus, artificial respiration, artificial nutrition, treatment of wounds, and re-amputations (the latter with Walter S. Priest).

Vol. II deals with the face and cranium, by Ellis Fischell; neck, thorax, abdomen, by Willard Bartlett; post-operative treatment of urological conditions, by John R. Caulk and Harry G. Greditzer; rectum and anus, by Francis Reder; obstetrics, by W. H. Vogt; and orthopædic work, by M. S. Henderson.

In nearly every case the writer has achieved a perfect monograph on his subject; almost every known theory is discussed and every known method of treatment indicated. The whole work reflects the very highest credit on Dr. Bartlett and on his choice of helpers. The opening chapter of the book by Dr. O. F. McKittrick on the "ideal post-operative room" will prove to those of us who operate in the usual English nursing home how far behind we are in this matter especially.

The printing, paper, and illustrations are of the best. One cannot too highly recommend the work.

Tumours Complicating Pregnancy, Labour, and the Puerperium. By HERBERT R. SPENCER, M.D., M.S., F.R.C.P. Pp. 78. Illustrated. 1920. London: Harrison & Sons. 5s. net.

THIS little book is a reprint of the Lettsomian Lectures delivered before the Medical Society of London in February and March, 1920. The chief feature of the lectures is the testimony they bear to the excellent consequences that have followed the intrusion of modern surgery into the stronghold of conservative midwifery.

The lectures are in the main an account of the lecturer's own experience and the methods he follows in the operative treatment of tumours complicating pregnancy. The most important section is that dealing with the treatment of cancer attacking the neck of the pregnant uterus.

The chief defect of these lectures, and a common one in gynæcological writings, is the long tables and tedious reports of cases that load the pages, and which few care to read or consult. In the opening lecture Dr. Spencer expresses his admiration for Horace, and he generously

presented to the library of the Medical Society a fine copy of the works of this poet, so that they may be consulted by the Fellows. Example is better than precept. Dr. Spencer on a future occasion will do well to follow the Horatian maxim expressed in the following lines :—

" Oh yes, believe me, you must draw your pen
Not once, not twice, but o'er and o'er again,
Through *cases and tables* if you'd entice ;
The man who reads you once to read you twice."

In this way the Lettsomian lecturer may

' Find audience fit, though few '.

Diagnosis and Treatment of Brain Injuries. By WILLIAM SHARPE, M.D., Professor of Neurological Surgery, New York. Large 8vo. Pp. 757; 232 illustrations. 1920. Philadelphia and London : J. B. Lippincott Co. 35s. net.

THE book is divided into three parts : (1) General considerations ; Pathology ; Diagnosis and Treatment ; Operative technique. (2) Brain injuries in adults : Illustrative cases, (*a*) acute, (*b*) chronic. (3) Brain injuries in newly-born babies and children : Illustrative cases, (*a*) acute, (*b*) chronic.

The author explains that he has named his book " Brain Injuries " rather than "Fractures of the Skull", as he is anxious to emphasize the great importance of the brain injury, the question of a fracture or not being only of minor significance. Indeed, as he points out, excluding depressed fractures, the presence of a fracture may be beneficial rather than otherwise, as it opens a way for relief to the all-important increase in intracranial tension. This aspect is insisted on again and again.

After giving the signs and symptoms of acute brain injuries, the author goes on to describe the changes in the fundi of the eyes, and the variations in pressure of cerebrospinal fluid as revealed by the spinal mercurial manometer at lumbar puncture. He lays great stress on these two methods of diagnosing increased intracranial pressure, and on their value as indicating the necessity or otherwise of operative procedure.

In the chapter on treatment he points out that two-thirds of the cases of acute brain injury (excluding depressed fractures) get well on expectant treatment, but the other one-third will require operation to relieve intracranial tension after the initial shock has been recovered from. His contention is that a percentage of this one-third, if not operated on, subsequently develop a chronic 'wet' brain to which he attributes the ill effects—headache, dizziness, etc.—so often seen after head injuries. Certainly his figures show the soundness of the principles underlying this line of treatment. In regard to this aspect of the subject, a very useful part of the work is that dealing with these injuries from the point of view of the Workman's Compensation Act. Emphasis is laid again and again on the necessity of taking the intracranial tension as the guide to treatment, and on diagnosing this early, long before the stage of onset of classical symptoms of bulbar pressure. One cannot but agree with this, and the importance of it renders repetition advisable, but its constant reiteration becomes at times rather irksome. There is nothing in the actual operative technique to notice especially, beyond the author's preference for a vertical incision instead of the usual curvilinear one ; his reasons for using this incision are the greater ease with which hæmorrhage is controlled, the easier access to the base of the skull, and the preservation of the attachments of the temporal muscle.

In Part 3, which deals with brain injuries in the newly-born and children, the necessity of recognizing intracranial tension is again emphasized. Here it is claimed that early operation would prevent many cases of spastic diplegia, and the impaired mentality associated therewith. Sixty per cent of these are due to intracranial hæmorrhage at birth, and would be prevented by an early operation to relieve the accompanying pressure.

Not the least interesting and instructive material in this excellent book is the recital of a large number of cases with full clinical histories, treatment, the subsequent progress of the patients, and the comments on each. Also an attempt is made to recognize the common mistakes in diagnosis by a routine post-mortem examination. The result of such an examination is attached to the history of the fatal cases.

The book is well illustrated, and has a comprehensive index, not only for the subject matter, but also for the illustrative cases.

Diseases of the Nose, Throat, and Ear. By W. S. SYME, M.D., Surgeon to the Ear and Throat Hospital, Glasgow. 8vo. Pp. 329 + viii. Illustrated. 1920. Edinburgh : E. & S. Livingstone. 9s. net.

IN this little manual the author has given us his experiences in this branch of medicine, and states that they are the outcome of his " own practice and observations ", and he expresses the

hope that "it may stimulate the interest of students in the speciality". We have little doubt that his wish will be fulfilled, because he has succeeded in giving a condensed and practical résumé of the subjects he has dealt with. The book is written in a chatty and easy style, and one can imagine that a stenographer has been present in the clinics and that his transcription is represented by the volume before us. Only on some such assumption can we account for many little errors and omissions which, from a personal knowledge of the author, we feel he would be the first to acknowledge and to correct in a future edition.

We hope the author will give us another edition of this useful little manual, but only on condition that he himself carefully revises it before it is handed over to the publishers.

Industrial Medicine and Surgery. By HARRY E. MOCK, B.S., M.D., F.A.C.S., Assistant Professor of Industrial Medicine and Surgery at Rush Medical College, etc. 8vo. Pp. 846, with 210 illustrations. 1919. Philadelphia and London: W. B. Saunders Co. 42s. net.

THIS work is designed to deal fully with the highly important subject of the preservation, and if necessary the restoration, of the health of employés in the industrial world; and it covers much ground which has hitherto been almost ignored by physicians and surgeons in this country. It is, in fact, the first attempt with which we are familiar, to deal completely with the medical problems upon which industrial efficiency so largely depends. As such its study is almost an essential to those who are engaged in directing the activities of a Ministry of Health, while it is full of valuable information for those engaged in factory inspection and in public health work generally, as well as for employers of labour and the technical advisers of trade unions. With a view to making it thus available for the public as well as the profession, it is written in non-technical language; and it is more bulky, even if more readable, than it need have been if designed for the surgeon only: but it contains much valuable information not readily obtainable elsewhere, and it should at least be open to consultation by all those engaged in industrial practice.

From the point of view of the surgeon, it makes no attempt to deal with the problems of the consulting-room, except perhaps in the chapters upon compensation, insurance, and other 'medico-legal' problems; but even upon the most highly technical questions it occasionally throws light. Thus it is interesting, in connection with a recent discussion by many distinguished surgeons upon the efficacy of iodine for sterilizing the skin, to note the remarkable diminution in septic infection after wounds of the hands, fingers, etc., produced by the systematic and immediate application of iodine to the injured part. "In 1909, when I first used iodine in every department of the industry with which I was connected, there was an immediate reduction of 28 per cent in the number of infections in the first month after this plan was installed." Other sections of the book which may be read with profit are those relating to mechanotherapy, functional re-education and the like, and to such important economic questions as injuries of the hand and the care of the feet.

Venereal Diseases: their Clinical Aspect and Treatment. By J. E. R. MCDONAGH, F.R.C.S., Surgeon to the London Lock Hospital. Pp. 419 + xii, with 106 coloured and 21 other illustrations. 1920. London: Wm. Heinemann Ltd. £3 3s. net.

THE reader who is acquainted with Mr. McDonagh's work during the past decade will expect to find in his latest book, now under review, an exposition of much original thought energetically expressed, and he will not be disappointed. He will be prepared to accord it that measure of respect which is due to the author's brilliant intellect, and the painstaking research with which he supports his theories; and if he does find much in Mr. McDonagh's theories and their practical application to treatment which does not seem entirely to accord with his own experience, he will freely admit that the book has somewhat shifted his view-point and has perhaps stirred him out of that routine line of thought which so sadly interferes with progress. The present book, as its title implies, is mainly concerned with the clinical aspect of venereal lesions and their treatment. The pathological aspect is touched upon only for the purpose of explaining clinical events and treatment; but a work devoted purely to the pathology of venereal disease is promised at an early date. As an exposition of the clinical features of venereal disease we have no hesitation in considering this the best modern work on the subject. The descriptions are excellent, and are illustrated profusely by coloured plates which show that the author was determined to spare no pains to convey his meaning to the mind of the reader. It is true that some of the plates have not entirely escaped that artificial touch which is so common in coloured representations of clinical lesions; but the author does not claim to teach entirely by the book; he very properly insists on the necessity of studying the living specimen. On the question of treatment Mr. McDonagh has pronounced views which appear at first to be widely different from those at present regarded as orthodox, and may not yet receive universal acceptance; but it will be found possible to agree with most of the author's teaching. Frankly, we would hesitate to treat a case of syphilis with

maximal doses of arseno-benzene at short intervals, relying on intramine and colloidal iodine to save the susceptible patient from poisoning by this procedure, because we have somewhat frequently seen these remedies fail to save the situation ; on the other hand, we heartily agree with the advice to commence before the disease has become generalized and to follow up the first course of arseno-benzene and other injections with further antisyphilitic treatment for a period of many months. We would not take the author's view that the urethroscope is practically useless, but we certainly agree that much of the tinkering to which the genital passages are subjected, and much of the caustic with which they are tortured, might well be omitted. This fault is largely due to the lack of clinical as distinct from book experience of many workers at the present day. In this matter Mr. McDonagh is giving the pendulum a strong push in the other direction ; but we feel that the steadying influence of clinical experience will have its usual effect. As is well known, Mr. McDonagh places chief reliance in gonorrhœa on local washing, on his own chemotherapeutic agents, colloidal manganese and palladium with colloidal iodine and intramine, and on the use of detoxicated vaccines. As to the value of the colloidal remedies mentioned, there are differences of opinion, and the reader must decide the question for himself by clinical trial.

It is not unfair to Mr. McDonagh to advise the reader who is unacquainted with the subject of venereal disease not to confine his study to this book, but to read also one in which pathology and treatment proceed on more orthodox lines. His reading of both works will not enable him to form a judgement ; yet, if he will carefully study the living book also, though he may not agree entirely with Mr. McDonagh in the end, he will find that he has profited far more by reading this work than if he had confined himself to an ordinary text-book.

Gonococcal Infection in the Male. By NORMAN LUMB, O.B.E., M.B., B.S.(Lond.) Large 8vo. Pp. 328, with 165 illustrations (including 35 fully coloured). 1920. London : Bale, Sons & Danielsson Ltd. 25s. net.

THIS work appears to be largely based on the author's experience as officer-in-charge of a gonorrhœa division of a large military V.D. Hospital, and doubtless on his opportunities of comparing his experience with that of others in the same Hospital, which afforded him access to the records of about 50,000 cases of gonorrhœa. As a result of this and his careful study of modern works, the author presents a digest of the subject which will be found of great practical value by practitioners and students. The outstanding feature of the work is undoubtedly the section on urethroscopy, to which one-sixth of the text and nearly half the illustrations are devoted. The author states his belief in this connection that, without urethroscopy, a high standard of cure cannot be attained. The technique is described very completely, and illustrated by numerous valuable reproductions of photographs of the actual procedure. In addition there are a number of coloured plates showing the appearance of the urethra in health and disease.

Only a few points appear to call for criticism, which is offered in the hope that it may prove useful in the preparation of future editions. On page 28 the two-glass test is described as a useful guide to the condition of the anterior urethra when the acute stage is passing off ; but in the next paragraph the author advises a much more complicated method of examination, apparently for use in the same stage of the disease. If the first-mentioned is a useful and reliable method, which we rather doubt, there would appear to be no necessity for the more troublesome second method. On page 33, in considering examination of the urine in the *acute* stage, it is stated that palpation of the anterior urethra and massage of Littré's glands enables the surgeon to diagnose littritis, apparently because the urine passed after this manœuvre contains many light comma threads. The author omits to mention how he distinguishes these threads in the turbid urine of acute gonorrhœa, or how he detects any but gross infiltrates by palpation of the empty bladder. The method of aborting gonorrhœa in its earlier stages by instituting injection of silver nitrate so strong as 10 gr. to the ounce, which the author favours after irrigating for two days (p. 52), requires very careful selection of cases, since its failure to abort the disease may leave the patient in a bad condition for subsequent treatment. We suggest, therefore, some tightening of the conditions which determine suitability for this form of treatment.

The author has not been so successful in arrangement of his section on complications as in that of other parts of the book. Thus the subjects of arthritis and tenosynovitis are followed by peri-urethral abscess, cowperitis, cystitis, and warts, incidentally all within Chapter X, which is headed 'Arthritis'. These are followed, in the next chapter, by descriptions of keratodermia blenorrhagica, thrombosis of the dorsal vein of the penis, œdema of the prepuce, abscess of Tyson's gland, suppuration of lymph glands, para-urethral tracks, infection of the rectum, endocarditis, and syphilis complicating gonorrhœa, all in the order named, so that it is rather difficult to understand the principle of the arrangement. If we may venture one more criticism, we would suggest that keratodermia blenorrhagica, though a most interesting complication, is too rare to deserve twelve pages of text and eight plates in a work of this size. Our criticisms relate, however, to not important details, and should not detract very greatly from the value of this useful book.

Anæsthetics: Their Uses and Administration. By DUDLEY WILMOT BUXTON, M.D., B.S. Sixth edition. Demy 8vo. Pp. xiv + 548, with 97 illustrations. 1920. London: H. K. Lewis & Co. Ltd. 21s. net.

IN order to bring this work up to date, the author has introduced a good deal of new matter and remodelled some of the old.

The chapter on complications and accidents gives us a fair résumé of what may be regarded as established facts concerning shock, and this chapter now includes a new section dealing with hæmorrhage, and a description of blood transfusion which might with advantage have been written much more fully.

As to new or modified methods, Dr. Buxton gives special consideration to the employment of warmed anæsthetic vapours; anoci-association; intratracheal chloroform; gas and oxygen; and spinal and regional analgesia.

One realizes that the information contained in this book has been well selected, and that the views expressed are reliable and well established.

Manuel d'Uretroscopie. By ROBERT HENRY and ANDRÉ DEMONCHY; with a Preface by Dr. MARION. Pp. 116; 86 figures in the text, 30 in colour. 1920. Paris: Masson et Cie. 25 fr. net.

THIS small volume contains a description of the urethroscope and its use. A number of varieties of the instrument are described in detail; one chapter is devoted to the technique of urethroscopy and another to a discussion of the different forms of urethroscope. The relative values of an external reflected light and an internal light are considered, and the authors decide in favour of the latter. Dr. Demonchy has introduced a modification of the Luys urethroscope, with a small telescope in place of a rotating lens, and this is fully described and illustrated.

Chapter V deals with the normal urethra, and is illustrated by twelve excellent coloured urethroscopic views. In Chapter VI (8½ pages) pathological conditions of the urethra are described. Most of this chapter is occupied by a description of urethritis and stricture. Growths of the urethra are mentioned, but not described. Urethroscopic treatment is discussed, and urethroscopy in the female is the subject of a short note.

The book is written in a simple, easily-read style. It is printed on good paper and the illustrations are numerous and useful. The black-and-white illustrations are well drawn and done in the delicate line typical of French medical illustration. The coloured urethroscopic views are good and are more natural than any we have seen in similar French medical works.

The discussion of pathological conditions of the urethra is meagre, and if extended would add greatly to the practical value of the book. The manual is recommended as a useful introduction to the study of urethroscopy.

SHORT NOTES ON BOOKS.

Massage: its Principles and Practice. By JAMES B. MENNELL. Second edition. With 167 illustrations. 1920. London: J. & A. Churchill. 21s. net.

WE greatly welcome this second edition of Dr. Mennell's important book, not only because of the conviction and the enthusiam which inspire him, but because it represents the actual practice now being so successfully carried out at St. Thomas's Hospital.

The chapters on the re-education of muscle, the combination of massage and splintage in orthopædic surgery, and the re-education of amputation cases represent the new features of the present edition, and the general principle is again and again enforced that massage is merely a small part of the general method of rehabilitation of injured tissues for renewed functional activity.

DaCosta's Modern Surgery. Eighth edition. Pp. 1696, with 1177 figures, some of them in colour. 1919. Philadelphia and London: W. B. Saunders Co. 37s. 6d. net.

THIS is a remarkable testimony to the energy and resource of the author, who produced the last edition in 1914, and now, in spite of the war and the absence of his assistants, has given us this new volume with nearly 200 pages more letterpress and many more illustrations than the last. The work is one of the few survivals of the single-author surgical text-book, though its writer acknowledges the assistance of many colleagues. As in former editions, the illustrations do not conform to a modern standard of excellence. The preface, with its racy quotations, is the most readable part of the whole book, and the volume is closely packed with sound surgical teaching.